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THE

MISCELLANEOUS DOCUMENTS

OF THE

HOUSE OF REPRESENTATIVES

FOR THE

SECOND SESSION OF THE FIFTY-THIRD CONGRESS.

1893-'94.

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CHARLES D. WALCOTT, DIRECTOR

A SYNOPSIS

OF

AMERICAN FOSSIL BRACHIOPODA

INCLUDING

BIBLIOGRAPHY AND SYNONYMY

BY

CHARLES SCHUCHERT

WASHINGTON
GOVERNMENT PRINTING OFFICE
1897

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LETTER OF TRANSMITTAL.

UNITED STATES NATIONAL MUSEUM,
Washington, D. C., January 9, 1897.

SIR: I have the honor to transmit herewith the manuscript of A Synopsis of American Fossil Brachiopoda, including Bibliography and Synonymy, which has been prepared out of official hours. It is presented with a view to its publication as a bulletin by the United States Geological Survey.

CHARLES SCHUCHERT.

Hon. CHARLES D. WALCOTT,
Director of the United States Geological Survey.

PREFACE.

Probably no continent is more productive of well-preserved Paleozoic brachiopods than North America. Throughout the vast territory of the United States which is drained by the Mississippi River the strata have suffered little change, and it is this region which has furnished nearly all the material, from the Middle Ordovician to the top of the Upper Carboniferous. The numerous species of American Cambrian brachiopods which are found scattered along the margins of this great interior plateau and throughout New Brunswick have also aided largely in determining the evolution of the class. To Mr. Walcott, Director of the United States Geological Survey, much honor is due for making clear the structure of brachiopods from this system.

The present synopsis was begun in Cincinnati eleven years ago, while the writer was engaged in paleontologic work with Mr. E. O. Ulrich. In 1887, when the list had increased to about 700 cards, the position of assistant to Prof. James Hall was entered upon. A nearly complete library of American paleontologic literature thus became available to the writer, and during the next two years the greater part of his leisure was devoted to recording brachiopod literature. The large private collection of brachiopods belonging to Professor Hall, together with the many public and private collections then under investigation by Hall and Clarke, also afforded the writer abundant facilities and a rare opportunity for the study of this class. Every occasion was embraced to examine into the synonymy suggested by authors, and in this work it is believed much has been attained. In addition to the above collections and to the material in his own possession, the writer has also studied the specimens belonging to this class in the American Museum of Natural History, Yale University Museum, Cincinnati Society of Natural History, and the United States National Museum. In 1890 the present catalogue comprised upward of 3,500 cards, arranged in boxes having a united length of about 4 feet. It now includes nearly 10,000 references relating to North and South American fossil brachiopods.

It is believed that with the exception of local faunal lists all the literature of North and South America pertaining to this subject is recorded in the following synopsis. Much possible synonymy which the writer could not satisfactorily determine is noted under "Observations." The complete known distribution of widely dispersed species

is not always given, only the more important localities being cited. In every case, however, the locality first mentioned is believed to be the original one.

For the proper generic disposition of the species the work of Hall and Clarke[1] has been closely followed, and the entire synopsis is arranged alphabetically to facilitate easy finding. The geologic distribution of the genera is given at the end of Chapter I, and their systematic position in the classification in Chapter V. The evolution of the lophophore, from the simple crescentic condition with few tentacles of the protegulum to the most complex condition in the Terebratulacea, described in Chapter IV, is wholly the work of Dr. Beecher. From the development of this organ in recent species the peculiarly complicated growth of the lophophore in the Spiriferacea is also explained. Some of the embryonic brachial conditions are likewise indicated as probably existing in a mature condition in early Paleozoic genera.

The danger of neglecting young or small specimens of any organism can not be too often impressed upon collectors. Often by means of such fossils intricate problems in phylogeny or life history may be solved. To have much value, however, young specimens must be very small, and these can not be picked up in the field. Where brachiopods abound, whether in clay or of a siliceous nature in limestone, material should be collected in bulk and prepared later by washing or etching with weak muriatic acid. This method of collecting generally results in securing fossils that otherwise will not be observed.

To Dr. Charles E. Beecher, of Yale University Museum, the best thanks of the writer are especially due for the continued interest taken in this catalogue, as well as for valuable suggestions regarding classification; and to Mr. Charles D. Walcott, Director of the United States Geological Survey, for favors relating to the publication of the paper.

To the following gentlemen the grateful acknowledgments of the writer are due for specimens or for suggestions in synonymy: Prof. J. F. Whiteaves, Canadian Geological Survey; Prof. H. S. Williams, Yale University; Director Charles D. Walcott, Dr. W. H. Dall, Dr. T. W. Stanton, and Dr. George H. Girty, United States Geological Survey; Prof. R. P. Whitfield, American Museum of Natural History; Prof. N. H. Winchell, State geologist of Minnesota; Mr. E. O. Ulrich, Newport, Kentucky; Mr. S. A. Miller, Cincinnati, Ohio; Mr. R. R. Rowley, Louisiana, Missouri, and Mr. D. K. Gregor, Fulton, Missouri; and to Dr. C. Davies Sherborn, of the British Museum, for valuable suggestions in bibliography.

C. S.

[1] Palæontology of New York, Vol. VIII, 1892–95.

A SYNOPSIS OF AMERICAN FOSSIL BRACHIOPODA, INCLUDING BIBLIOGRAPHY AND SYNONYMY.

By Charles Schuchert.

CHAPTER I.

GEOLOGIC DEVELOPMENT AND GEOGRAPHIC DISTRIBUTION OF AMERICAN FOSSIL BRACHIOPODA.

GEOLOGIC DEVELOPMENT.

Upward of 2,500 species of brachiopods have been described or identified from the sediments of the North and South American continents and adjacent islands. Of these, 2,053 are recognized in this catalogue, the other species, about 20 per cent, being considered as synonyms.

Little is known of the fossil forms from South America. Forty-eight genera are represented by 159 species, ranging from the Cambrian upward. Of these, 125 are from the Paleozoic and 34 from the Mesozoic. The Cambrian, Ordovician, and Jurassic brachiopods require further study, since authors have given little or no attention to their internal characters, and also have too readily identified them with well-known European species.

In North America there are 1,922 species, of which 1,859 are restricted to the Paleozoic. In 1880 Zittel,[1] on the basis of Bigsby's Thesaurus, gave a total of 4,243 species of Paleozoic Brachiopoda. Since Bigsby's compilation the total has probably been increased to 6,000 species, about one-third of which occur in North America. On account of their good preservation and great abundance, both in species and individuals, throughout the Paleozoic, the brachiopods in North America are of particular value in stratigraphic and correlative geology.

In the Mesozoic there is a remarkable scarcity of brachiopods, since but 49 species have been recorded, and many of these are rare. The Cenozoic representation is even smaller, there being but 14 species. This scarcity of post-Paleozoic brachiopods is very apparent in the oldest system of the Mesozoic, the Triassic, from which but 11 species have been described, whereas in the Carboniferous there are 478

[1] Handbuch der Palæontologie, Vol. I, 1880, pp. 709–710.

species. In marked contrast, also, is this lack of brachiopod continuity when compared with the Alpine Trias, from which Bittner has described 380 species; but nowhere else is this system known to have so large a development. This evidence not only indicates a decadence of the class during late Paleozoic, but epeirogenic movements as well near the close of the American Carboniferous, for none of the 478 species of this system pass into the Trias.

With the Trias a new facies of brachiopod life is initiated; many of the familiar types of Paleozoic shells had, at that time, long since ceased to live or had ended in the Carboniferous or Permian. The superfamilies Acrotretacea, Obolacea, and Pentameracea have died out, while the Lingulacea, Discinacea, Craniacea, Strophomenacea, and Spiriferacea are sparingly represented, and commonly by small species. Before the close of the Jurassic system the Spiriferacea also disappeared, so that since the Cretaceous era the class is practically represented by rhynchonellas and terebratulas, with a few scattering species of Lingula, Crania, and Discinisca.

In the American Jurassic there are but 13 species, and all are rare. How remarkable is this representation when contrasted with the Jura of Europe, where certain beds of the Lias, Dogger, and Malm terranes contain millions of specimens of a few species belonging to the families Terebratulidæ and Rhynchonellidæ.[1] The Cretaceous has 26 species, also a meager representation, and yet "outside of Europe, North America is the most important for the occurrence of Cretaceous Brachiopoda."[2] The American Eocene has 9 species and the Neocene 5. The disparity between the European and American Cenozoic brachiopod faunas is partly due to the scarcity of marine deposits representing the different horizons in America.

The geographic distribution of the 63 post-Paleozoic species shows that 30 are found along the eastern and southern border of the United States, 15 on the Pacific Coast, and 18 from the Arctic Circle south to about the fortieth parallel and between the one hundredth and the one hundred and twentieth meridians.

The Trias of eastern North America, with its unfavorable shore deposits, has but one species, while the Cordilleran Sea[3] to the east of the Rocky Mountains has 7, and these were there followed by 5 other species in the Jurassic system. A larger brachiopod fauna may have existed in the deeper waters of the Atlantic Trias, but nothing of it is known. In Cretaceous times conditions were again more favorable, 10 forms being recorded from the Atlantic border of North America, 10 from the Pacific, and 6 from the interior Cordilleran Sea. Toward the close of the Cretaceous the Cordilleran Sea became more and more

[1] Zittel, op. cit., p. 714.

[2] Ibid., p. 716.

[3] For the areas covered by this and the Mississippian and Appalachian seas, see Walcott's presidential address, Geologic time as indicated by the sedimentary rocks of North America: Proc. Am. Assoc. Adv. Sci., Vol. XLII, 1893.

unfit for marine life, and no brachiopods are known from the Tertiary deposits of this area. From the eastern North American Tertiary 9 species are known, but only 2 from the Pacific border. In recent times conditions are apparently more favorable for the introduction and existence of brachiopods from other areas, as 14 species have been dredged from the Atlantic and 24 from the Pacific continental plateaus of North America.

The living forms are universally distributed in the seas of the world. Their range in depth is no less extended. They occur in shallow waters, at low-water mark, and varying degrees of depth, from 200 to 600 fathoms being the usual limit of the majority of species. Several far-ranging abyssal species were dredged in from 1,000 to 2,000 fathoms. The delicate transparent shell of that interesting little Terebratuloid, Liothyrina Wyvillei Davidson, was actually obtained in a living condition by the *Challenger* expedition from the enormous depth of 2,900 fathoms, or 3½ miles, at the bottom of the South Atlantic Ocean.[1]

In the North American Cambrian there are 116 species described, a far greater development than in any other country. Davidson records but 14 species in Great Britain, while Bigsby, in 1868, gave the total for this system as 126 for all countries. In the next, or Ordovician, system the rapidity of brachiopod differentiation is remarkable. There are 319 species known in North America, an increase nearly three times that of the Cambrian. Bigsby's percentage of increase for this system is even greater, since in 1868 he listed 556 Ordovician species, which represent a growth of nearly four and one-half times that of his Cambrian total of 126.

While there is much specific differentiation throughout the Ordovician, it is a notable fact that the essential types of brachiopods of this system are also found near its base in the Calciferous. In the Chazy, or next younger horizon, the species are very much like those of the Trenton, where this class has great and varied representation, which is maintained to the end of the Ordovician. It is also true that the species become more generalized structurally as the Cambrian is approached, and most rapidly so toward the base of the Ordovician.

The evolution of the Cambrian brachiopods is similar in its history to that of the Ordoyician, except that there the differentiation was along more fundamental structural lines. In the following table it is seen that the four orders of the class Brachiopoda began with the Lower Cambrian, and that throughout this system differentiation was mainly of family importance, since none of these divisions has many genera or species. Where minor groups occur in quantity it is always in the more primitive divisions, as in the Atremata. In none of the other three orders is there a similar rapid differentiation in the Cambrian.

[1]Agnes Crane, Geol. Mag., Dec. IV, Vol. II, 1895, p. 3 (extract).

Table showing the differentiation of the Brachiopoda during Cambrian time.

	Number of species.	Number of genera.	Number of families.	Atremata species.	Neotremata species.	Protremata species.	Telotremata species.
Upper Cambrian ...	51	14	8	30	4	17	.....
Middle Cambrian...	39	12	5	19	16	4	.....
Lower Cambrian ...	31	12	7	17	5	8	2

The earliest deep-water deposits of the Silurian, the Clinton formation, have a brachiopod fauna which is quite different from that of the Ordovician. The Atremata, Neotremata, and Protremata are much like those of the Ordovician, but the Spiriferacea of the Telotremata, the most characteristic brachiopods of the Silurian, have here attained a great variety of forms, with varied brachydial structures. Throughout the American Silurian the brachiopods show little structural differentiation, but in the Lower Helderberg, at the base of the Devonian, the spire-bearers are changing and assuming characters which are fully developed in the higher Devonian. Here also occur the oldest loop-bearers, or Terebratulacea, though the ontogeny of Zygospira seems to show that this superfamily originated in the Ordovician.

In the Mississippian Sea deposition was apparently quite continuous throughout Devonian and Carboniferous times, and not much interrupted by earth movements. The faunas of these systems in this area show no rapid evolution along any of the brachiopod phyla. The species of the basal member of the Carboniferous, the Waverly or Kinderhook, are not unlike those of the Chemung of the Upper Devonian, nor is there any great faunal difference between the Kaskaskia of the Lower Carboniferous and the productive Coal Measures above.

From the foregoing rapid summary of the geologic history of American brachiopods, it follows that differentiation in the Paleozoic is most rapid near the base of the older systems, and diminishes in force from the older to the younger geologic divisions. While earth movements in America were greater and more numerous during the early Paleozoic than later in and just previous to the close of this time, yet the early and rapid evolution of the class is probably due not only to the varying conditions produced by these movements but also to the greater plasticity of the class during the Cambrian and Ordovician eras.

There are 311 species in the American Silurian, increasing to 662 in the Devonian, while the Carboniferous representation declines to 478 species. In 1880 Zittel gave a total of 1,366 species for the Devonian, 871 for the Carboniferous, and but 30 for the Permian. Waagen's researches in the Permian of India, however, have increased this representation considerably.

There is no more striking evidence than these figures needed to show

the very rapid increase of the class during the Ordovician, its culmination in the Devonian era, and its rapid decline in the Carboniferous.

Of the 230 established Paleozoic genera, not fewer than 186 are represented in North America.

GEOGRAPHIC DISTRIBUTION.

The geographic distribution of North American Paleozoic brachiopods is extensive, since 30 per cent, or 537 species, had great areal or horizontal dispersion. One hundred and seventeen species are found in both the Mississippian and Cordilleran seas, and of these 36 are also known to occur in foreign countries. The number of species common to North America and other continents, however, is 121.

When considered chronologically, it is observed that 20 per cent of the Cambrian brachiopods have great geographic distribution, and that this increases to 32 per cent in the Ordovician, Silurian, and Devonian, and declines to 28 per cent in the Carboniferous. Greatest specific dispersion, however, is most noticeable in the Devonian and Carboniferous, where *Atrypa reticularis*, *Leptæna rhomboidalis*, *Orthothetes crenistriatus*, *Productus semireticulatus*, *P. punctatus*, *Rhynchonella pleurodon*, *Spirifer disjunctus*, and *S. striatus* have almost world-wide distribution and great vertical or chronologic range. Many similar species common to America and several European countries could be mentioned.

Specific distribution increases with ordinal rank. In the radical order Atremata 25 per cent had dispersion, increasing to 27 per cent in the Neotremata, and to 32 per cent in the Protremata and Telotremata.

From the above considerations it is evident that brachiopods, as a rule, can not be of great value in correlating over wide areas minor Devonian, but particularly Carboniferous, horizons. In the Cambrian, Ordovician, and Silurian, however, these fossils are of great value for stratigraphic purposes. Since post-Paleozoic brachiopods are not common in America, they can have little stratigraphic value, but in the Trias and Jura of Europe, where species and individuals are common, reliance can be placed upon them, and they are there regarded as next in importance to the Ammonoidea for correlation. When paleontology shall have advanced sufficiently, so that extracontinental correlation of Paleozoic formations can be taken up in detail, it will be seen that brachiopods, because of their wide dispersion, abundance, and favorable preservation, will be of great service in working out paths of migration and intercommunicating oceanic basins.

TABLE I.—*Brachiopod genera alphabetically arranged, their geologic distribution, and North American specific representation.*

[In the column "Ordinal rank" A., N., P., T. equal the first letters of Atremata, Neotremata, Protremata, and Telotremata, respectively. The geologic occurrence of non-American genera or the earlier appearance or later continuance of American genera in other countries is indicated by a black line. Small superior numerals indicate the number of species having distribution.]

Genus.	Ordinal rank.	South American species.	North American species.	Cambrian.	Ordovician.	Silurian.	Devonian.	Permian and Carboniferous.	Triassic.	Jurassic.	Cretaceous.	Tertiary.	Recent.
Acambona White	T.		2					2					
Acanthothyris d'Orbigny	T.												
Acrothele Linnarson	N.		5	5^{1}									
Acrotreta Kutorga	N.		5	5^{1}									
Actinoconchus McCoy	T.												
Agulhasia King	T.												
Amboccelia Hall	T.		7				5^{2}	2					
Amphiclina Bittner	T.												
Amphiclinodonta Bittner	T.												
Amphigenia Hall	P.	1	4				4^{1}						
Amphitomella Bittner	T.												
Anabia Clarke	T.	1											
Anastrophia Hall	P.		4			4^{2}							
Ancistrocrania Dall	N.												
Anisactinella Bittner	T.												
Anomactinella Bittner	T.												
Anoplia Hall and Clarke	P.		1				1^{1}						
Anoplotheca Sandberger	T.	1	10			3^{2}	7^{2}						
Antiptychina Zittel	T.												
Athyris McCoy	T.		29			3	9^{3}	17^{8}					
Atrypa Dalman	T.	1	20			10^{5}	11^{5}						
Atrypina Hall and Clarke	T.		4			3^{1}	1^{1}						
Aulacorhynchus Dittmar	P.		1					1^{1}					
Aulacothyris Douvillé	T.												
Aulosteges Helmersen	P.												
Austriella Bittner	T.												
Barroisella Hall and Clarke	A.		1				1^{1}						
Beachia Hall and Clarke	T.		1				1^{1}						
Beecheria Hall and Clarke	T.		1					1					
Billingsella Hall and Clarke	P.		12	9^{2}	2	7^{1}							
Bilobites Linnæus	P.		3			2^{1}	1^{1}						
Bittnerula Hall and Clarke	T.												
Botsfordia Matthew	A.		1	1									
Bouchardia Davidson	T.												
Branconia Caegel	P.												
Cadomella M. Chalmas	P.												
Camarella Billings	P.		10		9^{2}	1							
Camarophorella Hall and Clarke	P.		1					1					
Camarophoria King	P.		9				1	8^{3}					
Camarospira Hall and Clarke	T.		1				1^{1}						
Camarotœchia Hall and Clarke	T.	1	32		1^{1}	9^{2}	20^{10}	4^{2}					
Camerothyris Bittner	T.												
Capellinia Hall and Clarke	P.		1			1							
Cardinocrania Waagen	N.												

TABLE I.—*Brachiopod genera alphabetically arranged, etc.*—Continued.

Genus.	Ordinal rank.	South American species.	North American species.	Cambrian.	Ordovician.	Silurian.	Devonian.	Permian and Carboniferous.	Triassic.	Jurassic.	Cretaceous.	Tertiary.	Recent.
Catazyga Hall and Clarke	T.		3		3^{2}								
Centronella Billings	T.	2	10				7^{2}	3^{1}					
Charionella Billings	T.		1				1^{1}						
Chascothyris Holzapfel	T.						—						
Chonetella Waagen	P.							—					
Chonetes Fischer de Waldheim	P.	13	47			5^{2}	22^{10}	22^{12}					
Chonetina Krotow	P.							—					
Chonopectus Hall and Clarke	P.		1					1^{1}					
Chonostrophia Hall and Clarke	P.	1	4				4^{2}						
Christiania Hall and Clarke	P.		1				1						
Cincta Quenstedt	T.									—			
Cistella Gray	T.										—	—	—
Cleiothyris King	T.	1	10					10^{3}					
Clintonella Hall and Clarke	T.		1			1							
Clitambonites Pander	P.	1	3		3^{1}								
Clorinda Barrande	P.		5			5^{2}							
Cœnothyris Douvillé	T.								—				
Conchidium Linnæus	P.		20			18^{2}	?2						
Conotreta Walcott	N.		1		1^{1}								
Cranæna Hall and Clarke	T.		2				2^{2}						
Crania Retzius	N.		34	?1	9^{3}	9^{1}	11^{3}	4^{1}	—	—	—	—	—
Craniella Œhlert	N.		3		?1	?1	1^{1}						
Craniscus Dall	N.									—			
Cruratula Bittner	T.								—				
Cryptacanthia White and St. John	T.		1					1					
Cryptonella Hall	T.		11			1	9^{3}	3^{1}					
Cryptopora Jefferys	T.												—
Cyclorhina Hall and Clarke	T.		1				1^{1}						
Cyclospira Hall and Clarke	T.		2		1^{1}	?1							
Cyrtia Dalman	T.		6			3^{2}	2^{1}	1^{1}					
Cyrtina Davidson	T.	1	21			1^{1}	15^{6}	5	—				
Dallina Beecher	T.											—	—
Dalmanella Hall and Clarke	P.	1	38		22^{10}	4^{2}	11^{4}						
Davidsonella M. Chalmas	P.									—			
Davidsonia Bouchard	P.						—						
Daviesiella Waagen	P.							—					
Dayia Davidson	T.					—							
Delthyris Dalman	T.		7			2^{1}	5^{4}						
Derbya Waagen	P.	1	12					12^{2}					
Dicamara Hall and Clarke	T.						—						
Dictyonella Hall	P.		5			5^{1}							
Dictyothyris Douvillé	T.									—			
Dielasma King	T.	2	11				1^{1}	10^{6}					
Dielasmina Waagen	T.							—					
Dignomia Hall	A.		1				1						
Dimerella Zittel	T.								—				
Dinarella Bittner	T.								—				
Dinobolus Hall	A.		4		3^{1}	1^{1}							
Dinorthis Hall and Clarke	P.		12		12^{8}								
Dioristella Bittner	T.								—				

TABLE I.—*Brachiopod genera alphabetically arranged, etc.*—Continued.

Genus.	Ordinal rank.	South American species.	North American species.	Cambrian.	Ordovician.	Silurian.	Devonian.	Permian and Carboniferous.	Triassic.	Jurassic.	Cretaceous.	Tertiary.	Recent.
Diplospirella Bittner	T.								—				
Discina Lamarck	N.		6	?1	?1			?1	—	—	3	—	—
Discinisca Dall	N.		2									2[2]	—
Discinolepis Waagen	N.			—									
Discinopsis Matthew	N.		1	1									
Discolia Fischer and Œhlert	T.												—
Disculina Deslongchamps	T.									—			
Eatonia Hall	T.		9				9[2]						
Eichwaldia Billings	P.		1		1								
Elkania Ford	A.		2	1	1								
Enantiosphen Whidborne	P.						—						
Enteletes Fischer de Waldheim	P.	2	1					1[1]					
Epicyrta Deslongchamps	T.									—			
Etheridgina Œhlert	P.							—					
Eucalathis Fischer and Œhlert	T.												—
Eudesella M. Chalmas	P.									—			
Eudesia King	T.									—			
Eumetria Hall	T.		4					4[1]					
Eunella Hall and Clarke	T.		4				4[3]						
Euractinella Bittner	T.								—				
Fimbriothyris Deslongchamps	T.									—		—	
Frenulina Dall	T.												—
Frieleia Dall	T.												—
Glassia Davidson	T.		1		1	—							
Glassina Hall and Clarke	T.					—							
Glossina Phillips	A.	2	13		5[1]	1	3[1]	4[1]					
Glossothyris Douville	T.									—			
Glottidia Dall	A.												—
Grunewaldtia Tschernyschew	T.					—	—						
Gwynia King	T.												—
Gypidula Hall	P.		14			6	8[2]						
Harttina Hall and Clarke	T.	1	1					1					
Hebertella Hall and Clarke	P.		12		10[4]	2							
Helmersenia Pander	N.				—								
Hemipronites Pander	P.				—								
Hemiptychina Waagen	T.							—	—	—	—	—	
Hemithyris d'Orbigny	T.		1									1	—
Heterorthis Hall and Clarke	P.		1		1								
Hindella Davidson	T.		2			2[1]							
Hipparionyx Vanuxem	P.		1				1[1]						
Homœospira Hall and Clarke	T.		3			3							
Hustedia Hall and Clarke	T.	1	4					4[1]					
Hyattella Hall and Clarke	T.		2			2[1]							
Hynniphoria Suess	T.									—			
Hypothyris King	T.		3				3[2]						
Iphidea Billings	N.		8	8[3]									
Ismenia King	T.									—			
Juvavella Bittner	T.								—				
Juvavellina Bittner	T.								—				
Karpinskya Tschernyschew	T.						—						

TABLE I.—*Brachiopod genera alphabetically arranged, etc.*—Continued.

Genus.	Ordinal rank.	South American species.	North American species.	Cambrian.	Ordovician.	Silurian.	Devonian.	Permian and Carboniferous.	Triassic.	Jurassic.	Cretaceous.	Tertiary.	Recent.
Kayserella Hall and Clarke	P.						—						
Kayseria Davidson	T.						—						
Kingina Davidson	T.		2							—	2		
Koninckella M. Chalmas	T.									—			
Koninckina Suess	T.								—				
Koninckodonta Bittner	T.								—				
Kraussina Davidson	T.												—
Kutorgina Billings	P.		1	1									
Lacazella M. Chalmas	P.									—	—	—	—
Lacqueus Dall	T.												—
Lakmina Œhlert	A.			—									
Leiorhynchus Hall	T.		18				15^{7}	3					
Leptæna Dalman	P.	1	4		3^{2}	1^{1}	2^{2}	1					
Leptænisca Beecher	P.		3				3^{1}						
Leptella Hall and Clarke	P.		2		2^{1}								
Leptembolon Mickwitz	A.				—								
Leptobolus Hall	A.		4		4^{2}								
Lindstrœmella Hall and Clarke	N.		1				1						
Lingula Brugiere	A.	11	102	?7	36^{13}	12^{1}	28^{5}	17^{2}	—	1	3^{2}	—	—
Lingulasma Ulrich	A.		2		2^{1}								
Lingulella Salter	A.		21	19^{2}	3		?1^{1}						
Lingulepis Hall	A.		9	9^{2}	1								
Lingulodiscina Whitfield	N.		4				1	3^{1}					
Lingulobolus Matthew	A.		1	1									
Lingulops Hall	A.		3		2	1							
Linnarsonia Walcott	N.		4	4^{2}									
Liothyrina Œhlert	T.											—	—
Lissopleura Whitfield	T.		1				1						
Lycophoria Lahusen	P.					—							
Lyra Cumberland	T.										—		
Lyttonia Waagen	P.							—					
Macandrewia King	T.												—
Magas Sowerby	T.										—		
Magellania Bayle	T.		1							—		1	—
Mannia Dewalque	T.										—	—	
Martinia McCoy	T.		10				7[1]	3^{2}	?				
Martiniopsis Waagen	T.							—	?				
Meekella White and St. John	P.		4					4^{1}					
Megalanteris Suess	T.		2				2						
Megathyris d'Orbigny	T.									—	—	—	—
Megerlina Deslongchamps	T.												—
Mentzelia Quenstedt	T.									—			
Merista Suess	T.		3				3						
Meristella Hall	T.	1	21				20^{9}	1					
Meristina Hall	T.		3			3^{2}							
Mesotreta Kutorga	N.				—								
Metaplasia Hall and Clarke	T.		2				2^{1}						
Mickwitzia Schmidt	A.			—									
Microthyris Deslongchamps	T.									—	—		
Mimulus Barrande	P.		1			1							
Monobolina Salter	N.				—								

TABLE I.—*Brachiopod genera alphabetically arranged, etc.*—Continued.

Genus.	Ordinal rank.	South American species.	North American species.	Cambrian.	Ordovician.	Silurian.	Devonian.	Permian and Carboniferous.	Triassic.	Jurassic.	Cretaceous.	Tertiary.	Recent
Monomorella Billings	A.		9			9[4]							
Muhlfeldtia Bayle	T.											—	—
Neobolus Waagen	A.			—									
Newberria Hall	T.		4				4						
Nœtlingia Hall and Clarke	P.				—								
Norella Bittner	T.								—				
Notothyris Waagen	T.	1						—					
Nucleatula Bittner	T.								—				
Nucleospira Hall	T.		7			2[1]	4[2]	1					
Obolella Billings	A.		12	12[4]	2								
Obolus Eichwald	A.		2	2									
Oldhamina Waagen	P.							—					
Orbicella d'Orbigny	N.				—								
Orbiculoidea d'Orbigny	N.	2	40		1[1]	5	16[5]	18[6]	—	—	—		
Oriskania Hall and Clarke	T.		1				1						
Orthidium Hall and Clarke	P.		1		1								
Orthis Dalman	P.	6	48	6	23[6]	16[1]	2	1					
Orthoidea Friren	T.									—			
Orthorhynchula Hall and Clarke	T.		1		1[1]								
Orthostrophia Hall	P.		2			2[1]							
Orthothetes Fischer de Waldheim	P.	2	21			4[1]	12[5]	6[5]					
Orthotichia Hall and Clarke	P.	1						—					
Orthotrophia Hall and Clarke	P.		1			1							
Parastrophia Hall and Clarke	P.		10		5[2]	5							
Parazyga Hall and Clarke	T.		2				2[1]						
Paterula Barrande	A.		1		1								
Pentactinella Bittner	T.								—				
Pentagonia Cozzens	T.		1				1[1]						
Pentamerella Hall	P.		9			1	8[2]						
Pentamerus Sowerby	P.		7			7[4]							
Peregrinella Œhlert	T.										—		
Pexidella Bittner	T.								—				
Pholidops Hall	N.		17		4[1]	3[2]	10						
Pholidostrophia Hall and Clarke	P.		1				1[1]						
Platidia Costa	T.												—
Platystrophia King	P.		6		6[1]	1							
Plectambonites Pander	P.	1	8		3[1]	6[1]							
Plectorthis Hall and Clarke	P.		11		10[2]		1						
Plesiothyris Douvillé	T.									—	—		
Plicigera Bittner	T.								—				
Polytœchia Hall and Clarke	P.		1		1								
Pomatospirella Bittner	T.								—				
Porambonites Pander	P.				—								
Proboscidella Œhlert	P.		1					1					
Productella Hall	P.	1	32				28[2]	6[5]					
Productus Sowerby	P.	16	87					87[27]					
Propygope Bittner	T.								—				
Protorhyncha Hall and Clarke	T.		3	2	1[1]								
Pseudocrania McCoy	N.				—	—							
Pterophloios Gümbel	P.									—			

TABLE I.—*Brachiopod genera alphabetically arranged, etc.*—Continued.

Genus.	Ordinal rank.	South American species.	North American species.	Cambrian.	Ordovician.	Silurian.	Devonian.	Permian and Carboniferous.	Triassic.	Jurassic.	Cretaceous.	Tertiary.	Recent.
Ptychospira Hall and Clarke	T.	.....	1	.....	.....	.....	.....	1	.....	.....	.....	.....	.....
Pugnax Hall and Clarke	T.	.....	12	.....	.....	.....	3^{2}	9^{3}	.....	.....	.....	.....	.....
Pygope Link	T.	.....	.....	.....	.....	.....	.....	.....	.....	—	.....	.....	.....
Rafinesquina Hall and Clarke	P.	.....	21	.....	20^{4}	$?1^{1}$	.....	.....	.....	.....	.....	.....	.....
Rensselæria Hall	T.	.....	9	.....	.....	.....	9^{2}	.....	.....	.....	.....	.....	.....
Reticularia McCoy	T.	1	22	.....	.....	2^{1}	10^{1}	10^{4}	.....	.....	.....	.....	.....
Retzia King	T.	1	6	.....	?1	.....	2	?3	?	.....	.....	.....	.....
Rhætina Waagen	T.	.....	.....	.....	.....	.....	.....	.....	—	.....	.....	.....	.....
Rhinobolus Hall	A.	.....	2	.....	.....	2	.....	.....	.....	.....	.....	.....	.....
Rhipidomella Œhlert	P.	3	44	.....	.....	8^{2}	24^{7}	13^{5}	.....	.....	.....	.....	.....
Rhynchonella Fischer de Waldheim	T.	14	104	.....	8^{2}	22^{6}	33^{1}	32^{3}	3	2	3	1	—
Rhynchonellina Gemmellaro	T.	.....	.....	.....	.....	.....	.....	.....	—	—	.....	.....	.....
Rhynchopora Œhlert	T.	.....	1	.....	.....	.....	.....	1^{1}	.....	.....	.....	.....	.....
Rhynchora Dalman	T.	.....	.....	.....	.....	.....	.....	.....	.....	.....	—	.....	.....
Rhynchorina Œhlert	T.	.....	.....	.....	.....	.....	.....	.....	.....	.....	—	—	.....
Rhynchospira Hall	T.	.....	10	.....	.....	3^{1}	5^{1}	2	.....	.....	.....	.....	.....
Rhynchotrema Hall	T.	.....	8	.....	7^{6}	.....	1	.....	.....	.....	.....	.....	.....
Rhynchotreta Hall	T.	.....	1	.....	.....	1^{1}	.....	.....	.....	.....	.....	.....	.....
Richthofenia Kayser	P.	.....	.....	.....	.....	.....	.....	—	.....	.....	.....	.....	.....
Rœmerella Hall and Clarke	N.	.....	1	.....	.....	.....	1^{1}	.....	.....	.....	.....	.....	.....
Romingerina Hall and Clarke	T.	.....	1	.....	.....	.....	.....	1^{1}	.....	.....	.....	.....	.....
Scaphiocœlia Whitfield	T.	1	.....	.....	.....	.....	—	.....	.....	.....	.....	.....	.....
Scenidium Hall	P.	.....	5	.....	2^{2}	1	2^{1}	.....	.....	.....	.....	.....	.....
Schizambon Walcott	N.	.....	4	.....	4	.....	.....	.....	.....	.....	.....	.....	.....
Schizobolus Ulrich	A.	.....	1	.....	.....	.....	1^{1}	.....	.....	.....	.....	.....	.....
Schizocrania Hall and Whitfield	N.	.....	5	.....	3^{1}	.....	2	.....	.....	.....	.....	.....	.....
Schizopholis Waagen	P.	.....	.....	—	.....	.....	.....	.....	.....	.....	.....	.....	.....
Schizophoria King	P.	1	13	.....	.....	1	9^{5}	3^{3}	.....	.....	.....	.....	.....
Schizotreta Kutorga	N.	.....	5	.....	4^{2}	1^{1}	.....	.....	.....	.....	.....	.....	.....
Selenella Hall and Clarke	T.	.....	1	.....	.....	.....	1	.....	.....	.....	.....	.....	.....
Seminula McCoy	T.	2	16	.....	.....	.....	.....	16^{4}	.....	.....	.....	.....	.....
Siphonotreta de Verneuil	N.	.....	2	.....	2^{1}	—	.....	.....	.....	.....	.....	.....	.....
Sphærobolus Matthew	A.	.....	1	1	.....	.....	.....	.....	.....	.....	.....	.....	.....
Spirifer Sowerby	T.	23	177	.....	.....	15^{7}	92^{22}	70^{19}	.....	.....	.....	.....	.....
Spiriferina d'Orbigny	T.	4	19	.....	.....	.....	.....	15^{7}	4	—	.....	.....	.....
Spirigerella Waagen	T.	1	.....	.....	.....	.....	.....	—	.....	.....	.....	.....	.....
Spondylobolus McCoy	A.	.....	.....	.....	—	.....	.....	.....	.....	.....	.....	.....	.....
Streptis Davidson	P.	.....	1	.....	.....	1^{1}	.....	.....	.....	.....	.....	.....	.....
Streptorhynchus King	P.	1	2	.....	.....	.....	.....	2	.....	.....	.....	.....	.....
Stricklandinia Billings	P.	.....	17	.....	.....	16^{3}	.....	?1	.....	.....	.....	.....	.....
Stringocephalus Defrance	T.	.....	1	.....	.....	.....	1^{1}	.....	.....	.....	.....	.....	.....
Strophalosia King	P.	1	12	.....	.....	.....	5^{2}	7	.....	.....	.....	.....	.....
Stropheodonta Hall	P.	1	58	.....	.....	12^{2}	46^{17}	.....	.....	.....	.....	.....	.....
Strophomena Blainville	P.	1	47	.....	31^{11}	13	2	1	.....	.....	.....	.....	.....
Strophonella Hall	P.	.....	16	.....	.....	4^{2}	12^{5}	.....	.....	.....	.....	.....	.....
Suessia Deslongchamps	T.	.....	.....	.....	.....	.....	.....	.....	.....	—	.....	.....	.....
Syntrophia Hall and Clarke	P.	.....	7	6^{1}	1	.....	.....	.....	.....	.....	.....	.....	.....
Syringothyris Winchell	T.	.....	9	.....	.....	.....	.....	9^{2}	.....	.....	.....	.....	.....
Terebratalia Beecher	T.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	—

TABLE I.—*Brachiopod genera alphabetically arranged, etc*—Continued.

Genus.	Ordinal rank.	South American species.	North American species.	Cambrian.	Ordovician.	Silurian.	Devonian.	Permian and Carboniferous.	Triassic.	Jurassic.	Cretaceous.	Tertiary.	Recent.
Terebratella d'Orbigny	T.	.....	5	.....	.....	.....	.....	.....	.....	—	5	—	—
Terebratula Llhwyd	T.	20	22	.....	.....	.....	3[1]	10	3	2	2	2	.....
Terebratulina d'Orbigny	T.	.....	6	.....	.....	.....	.....	.....	.....	—	4	2	—
Terebratuloidea Waagen	T.	.....	.....	.....	.....	.....	.....	—	.....	.....	.....	.....	.....
Tetractinella Bittner	T.	.....	.....	.....	.....	.....	.....	.....	—	.....	.....	.....	.....
Thecidella M. Chalmas	P.	.....	.....	.....	.....	.....	.....	.....	.....	—	.....	.....	.....
Thecidia Defrance	P.	.....	.....	.....	.....	.....	.....	.....	?	.....	—	.....	.....
Thecidiopsis M. Chalmas	P.	.....	.....	.....	.....	.....	.....	.....	.....	.....	—	.....	.....
Thecocyrtella Bittner	T.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Thecospira Zügmeyer	T.	.....	.....	.....	.....	.....	.....	.....	—	—	.....	.....	.....
Thysanotos Mickwitz	A.	.....	.....	.....	—	.....	.....	.....	.....	.....	.....	.....	.....
Tomasina Hall and Clarke	A.	.....	.....	.....	—	.....	.....	.....	.....	.....	.....	.....	.....
Torynifer Hall and Clarke	T.	.....	1	.....	.....	.....	.....	1	.....	.....	.....	.....	.....
Trematis Sharpe	N.	.....	14	.....	14[2]	.....	.....	.....	.....	.....	.....	.....	.....
Trematobolus Matthew	N.	.....	1	1	.....	.....	.....	.....	.....	.....	.....	.....	.....
Trematospira Hall	T.	.....	12	.....	.....	1	11[1]	.....	.....	.....	.....	.....	.....
Trigeria (Bayle) Hall and Clarke	T.	2	3	.....	.....	.....	3	.....	.....	.....	.....	.....	.....
Trigonosemus Koenig	T.	.....	.....	.....	.....	.....	.....	.....	.....	.....	—	.....	.....
Trimerella Billings	A.	.....	5	.....	.....	5[3]	.....	.....	.....	.....	.....	.....	.....
Triplecia Hall	P.	.....	7	.....	5	2	.....	.....	.....	.....	.....	.....	.....
Tropidoleptus Hall	T.	.....	2	.....	.....	.....	2[1]	.....	.....	.....	.....	.....	.....
Uncinella Waagen	T.	.....	.....	.....	.....	.....	.....	—	.....	.....	.....	.....	.....
Uncinulus Bayle	T.	.....	8	.....	.....	1[1]	7[3]	.....	.....	.....	.....	.....	.....
Uncites Defrance	T.	.....	.....	.....	.....	.....	—	.....	.....	.....	.....	.....	.....
Verneuilia Hall and Clarke	T.	.....	.....	.....	.....	.....	—	—	.....	.....	.....	.....	.....
Vitulina Hall	T.	.....	1	.....	.....	.....	1[1]	.....	.....	.....	.....	.....	.....
Volborthia von Möller	N.	.....	.....	—	.....	.....	.....	.....	.....	.....	.....	.....	.....
Whitfieldella Hall and Clarke	T.	.....	13	.....	.....	11[6]	2	.....	.....	.....	.....	.....	.....
Wilsonia Kayser	T.	.....	4	.....	.....	4[2]	1	.....	.....	.....	.....	.....	.....
Zeilleria Bayle	T.	.....	.....	.....	.....	.....	.....	.....	—	.....	.....	.....	.....
Zellania Moore	T.	.....	.....	.....	.....	.....	.....	.....	.....	—	.....	.....	.....
Zugmeyeria Waagen	T.	.....	.....	.....	.....	.....	.....	.....	—	.....	.....	.....	.....
Zygospira Hall	T.	.....	14	.....	10[5]	3	1	.....	.....	.....	.....	.....	.....
Total	....	154	1,894	103	311	320	655	482	10	5	22	9	32

TABLE II.—*North American Paleozoic representation of the orders, superfamilies, and families, geologically arranged.*

Order, superfamily, and family.	Number of species.	Number of genera.	Cambrian species.	Ordovician species.	Silurian species.	Devonian species.	Permian and Carboniferous species.
Order Atremata	196	19	57	60	31	30	21
Superf. Obolacea	43	9	22	6	17	.....	.....
Fam. Paterinidæ	8	1	8[3]	.....	.....	.....	.....
Obolidæ	17	4	16[4]	3	.....	.....	.....
Trimerellidæ	20	4	.....	3[1]	17[8]	.....	.....
Superf. Lingulacea	153	10	35	54	14	30	21
Fam. Lingulellidæ	35	4	28[6]	0[3]	.....	1[1]	.....
Lingulidæ	113	4	7	41[14]	13[1]	29[5]	21[3]
Lingulasmatidæ	5	2	.....	4[1]	1	.....	.....
Order Neotremata	153	21	20	44	21	42	26
Superf. Discinacea	99	18	19	30	8	20	22
Fam. Trematidæ	24	4	.....	17[3]	2	2[1]	3[1]
Discinidæ	50	5	1	6[3]	6[1]	18[6]	19[6]
Acrotretidæ	16	5	15[6]	1[1]	.....	.....	.....
Siphonotretidæ	7	3	1	6[1]	.....	.....	.....
Superf. Craniacea	54	3	1	14	13	22	4
Fam. Craniidæ	54	3	1	14[4]	13[3]	22[4]	4[1]
Order Protremata	735	62	22	173	161	210	179
Superf. Thecacea	608	45	16	152	96	185	169
Fam. Kutorginidæ	1	1	1	.....	.....	.....	.....
Eichwaldiidæ	6	2	.....	1	5[1]	.....	.....
Billingsellidæ	12	1	0[3]	2	1	.....	.....
Strophomenidæ	211	19	.....	65[19]	48[10]	77[21]	26[8]
Productidæ	186	9	.....	.....	5[1]	60[24]	125[48]
Orthidæ	192	13	6	84[32]	37[7]	48[16]	18[9]
Superf. Trullacea	127	17	6	21	65	25	10
Fam. Clitambonitidæ	9	3	.....	6[3]	1	2[1]	.....
Syntrophiidæ	7	1	6[1]	1	.....	.....	.....
Porambonitidæ	24	3	.....	14[4]	10[3]	.....	.....
Pentameridæ	87	10	.....	.....	54[12]	23[5]	10[3]
Order Telotremata	762	76	2	20	109	369	269
Superf. Rostracea	197	14	2	18	37	94	49
Fam. Protorhynchidæ	3	1	2	1[1]	.....	.....	.....
Rhynchonellidæ	194	13	.....	17[10]	37[12]	94[28]	49[9]
Superf. Terebratulacea	79	19	.....	.....	1	50	30
Fam. Centronellidæ	30	8	.....	.....	.....	26[8]	4[2]
Terebratulidæ	47	10	.....	.....	1	22[11]	26[7]
Tropidoleptidæ	2	1	.....	.....	.....	2[1]	.....
Superf. Spiriferacea	486	43	.....	2	71	225	190
Fam. Atrypidæ	45	8	.....	.....	14[7]	18	14[6]
Spiriferidæ	278	11	.....	1[1]	24[13]	138[48]	115[35]
Athyridæ	163	24	.....	1	33[14]	69[23]	61[14]

TABLES OF NORTH AND SOUTH AMERICAN SPECIES GEOLOGICALLY ARRANGED.

TABLE III, CAMBRIAN.—TABLE IV, ORDOVICIAN.—TABLE V, SILURIAN.—TABLE VI, DEVONIAN.—TABLE VII, CARBONIFEROUS AND PERMIAN.—TABLE VIII, MESOZOIC.—TABLE IX, CENOZOIC AND RECENT.—TABLE X, SOUTH AMERICAN FOSSIL BRACHIOPODA.

TABLE III.—*Cambrian Brachiopoda.*

[Species preceded by an asterisk (*) are found in the Ordovician also.]

Species.	Lower Cambrian.	Middle Cambrian.	Upper Cambrian.
Acrothele (?) dichotoma Walcott	×		
Acrothele matthewi (Hartt)		×	
Acrothele matthewi costata Matthew		×	
Acrothele matthewi lata Matthew		×	
Acrothele matthewi prima Matthew		×	
Acrothele subsidua (White)	×	×	
Acrotreta baileyi Matthew		×	
Acrotreta gemma Billings	×	×	×
Acrotreta gemma depressa Walcott		×	
Acrotreta gemmula Matthew		×	
Acrotreta microscopica (Shumard)		×	
Billingsella alberta (Walcott)		×	
Billingsella billingsi (Hartt)		×	
Billingsella coloradoensis (Shumard)			×
Billingsella festinata (Billings)	×		
Billingsella latourensis (Matthew)		×	
Billingsella orientalis (Whitfield)	×		
Billingsella quacoensis (Matthew)		×	
Billingsella transversa (Walcott)	×		
Billingsella whitfieldi (Walcott)	×		
Botsfordia pulchra Matthew		×	
Crania (?) columbiana Walcott		×	
Dalmanella melita (Hall and Whitfield)			×
Discina (?) inutilis Hall			×
Discinopsis gulielmi Matthew		×	
Elkania desiderata (Billings)			×
Iphidea bella Billings	×		
Iphidea labradorica (Billings)	×		
Iphidea labradorica swantonensis (Walcott)	×		
Iphidea ornatella Hall and Clarke			×
Iphidea pannula (White)	×	×	
Iphidea prospectensis (Walcott)	×		
Iphidea sculptilis (Meek)			×
Iphidea stissingensis (Dwight)		×	
Kutorgina cingulata Billings	×		
Kutorgina (?) pterinoides Matthew		×	
Lingula (?) calumet N. H. Winchell			
Lingula (?) elliptica Emmons	?		
Lingula (?) manticula White			×
Lingula (?) mosia Hall			×
Lingula (?) murrayi Billings			×
*Lingula quebecensis Billings			×
Lingula (?) striata Emmons	×?		
Lingulella ampla Owen		×	
Lingulella aurora Hall			×

TABLE III.—*Cambrian Brachiopoda*—Continued.

Species.	Lower Cambrian.	Middle Cambrian.	Upper Cambrian.
Lingulella (?) billingsana (Whiteaves)			×
Lingulella (?) cælata (Hall)	×		
Lingulella dawsoni Matthew		×	
Lingulella ella (Hall and Whitfield)	×	×	
Lingulella granvillensis Walcott	×		
Lingulella (?) inflata Matthew		×	
Lingulella (?) inflata ovalis Matthew		×	
*Lingulella irene (Billings)			×
Lingulella lævis Matthew			×
Lingulella lamborni Meek			×
Lingulella linguloides Matthew		×	
Lingulella macconelli Walcott		×	
Lingulella martinensis Matthew		×	
*Lingulella minuta Hall and Whitfield			×
Lingulella radula Matthew		×	
Lingulella starri Matthew		×	
Lingulella starri minor Matthew			×
Lingulella stoneana Whitfield			×
Lingulella winona Hall		×	
Lingulepis acuminata (Conrad)			×
Lingulepis acutangula (Roemer)			×
Lingulepis cuneolus Whitfield			×
*Lingulepis (?) mæra Hall and Whitfield			×
Lingulepis matinalis Hall			×
Lingulepis pinniformis Owen			×
Lingulepis prima (Hall)			×
Lingulepis primæformis Whitfield			×
Linnarsonia belti Davidson ?			×
Linnarsonia misera (Billings)		×	
Linnarsonia pretiosa (Billings)			×
Linnarsonia sagittalis taconica Walcott	×	×	
Linnarsonia transversa (Hartt)		×	
Obolella atlantica Walcott	×		
Obolella chromatica Billings	×		
Obolella circe Billings	×		
Obolella crassa (Hall)	×		
*Obolella (?) discoidea Hall and Whitfield			×
Obolella gemma Billings	×		
Obolella (?) gemmula Matthew			×
*Obolella (?) ida Billings			×
Obolella minuta (Hall and Whitfield)			×
Obolella nana Meek and Hayden		×	
Obolella nitida Ford	×		
Obolella pectenoides Whitfield			×
Obolella polita Hall		×	
Obolus (?) major Matthew	×		
Obolus (?) murrayi Billings		×?	
Obolus pristinus Matthew		×	
Obolus pulcher Matthew			×
Obolus refulgens Matthew			×
Orbicula (?) excentrica Emmons	×?		
Orthis (?) apicalis Billings			×
Orthis (?) eurekensis Walcott			×
Orthis (?) highlandensis Walcott	×		

TABLE III.—*Cambrian Brachiopoda*—Continued.

Species.	Lower Cambrian.	Middle Cambrian.	Upper Cambrian.
Orthis (?) lenticularis Wahlenberg	.....	.....	×
Orthis (?) lenticularis atrypoides Matthew	.....	.....	×
Orthis (?) lenticularis lynciodes Matthew	.....	.....	×
Orthis (?) lenticularis strophomenoides Matthew	.....	.....	×
Orthis (?) remnichia N. H. Winchell	.....	.....	×
Orthis (?) salemensis Walcott	×	.....	.....
Orthis (?) sandbergi N. H. Winchell	.....	.....	×
Orthisina (?) johannensis Matthew	.....	.....	×
Protorhyncha (?) antiquata (Billings)	×	.....	.....
Protorhyncha (?) minor (Walcott)	×	.....	.....
Syntrophia arachne (Billings)	.....	.....	×
Syntrophia arethusa (Billings)	.....	.....	×
Syntrophia (?) armanda (Billings)	.....	.....	×
Syntrophia barabuensis (A. Winchell)	.....	.....	×
Syntrophia calcifera (Billings)	.....	.....	×
Syntrophia primordialis (Whitfield)	.....	.....	×
Trematobolus insignis Matthew	.....	×	.....
Number of Cambrian species, 116.			
Number of species in each division	31	39	51
Number of species common to the Lower and the other divisions of the Cambrian	.....	5	1
Number of species common to the Middle and the other divisions of the Cambrian	5	.....	1
Number of species common to the Cambrian and Ordovician system, 6.			
Number of species passing from each division into the Ordovician	0	0	6

TABLE IV.—*Ordovician Brachiopoda.*

[Bi = Birdseye; BR = Black River; Ci = Cincinnati and Lorraine; EO = Eoordovician; MO = Meso-ordovician; NO = Neoordovician; T = Trenton; U = Utica. Species preceded by an asterisk (*) are found in the Silurian also; by an obelisk (†), in the Cambrian.]

Species.	Eoordovician.		Mesoordo-vician.	Neoordo-vician.
	Calcifer-ous.	Chazy.	Trenton, Black River, Birdseye.	Cincin-nati, Utica.
Billingsella (?) grandæva (Billings)	×			
Billingsella (?) primordialis (Whitfield)	×			
Camarella ambigua (Hall)			T	
Camarella breviplicata Billings	×			
Camarella (?) costata Billings	×			
Camarella longirostrum Billings		×		
Camarella panderi Billings			BR	
Camarella parva Billings	×			
Camarella polita Billings	×			
Camarella varians Billings	×	×		
Camarella volborthi Billings			BR	
Camarotœchia plena Hall		×		
Catazyga erratica Hall				Ci
Catazyga headi (Billings)				U, Ci
Clitambonites (?) borealis (Castelnau)			T	
Clitambonites diversa (Shaler)			T	Ci
Clitambonites diversa altissima Winchell and Schuchert			T	
Clitambonites plana retroflexa de Verneuil	×†			
Conotreta rusti Walcott			T	
Crania albersi Miller and Faber				U
Crania (?) deformis (Hall)		×		
Crania dyeri Miller				U
Crania granulosa N. H. Winchell			T	
Crania lælia Hall				U, Ci
Crania (?) reversa Sardeson		×		
Crania scabiosa Hall				U, Ci
Crania setigera Hall			T	Ci
Crania socialis Ulrich				U
Crania trentonensis Hall			T	
Craniella (?) ulrichi Hall and Clarke			T	
Cyclospira bisulcata (Emmons)			T	
Dalmanella amœna N. H. Winchell			T	
Dalmanella bellula (James) Meek sp				Ci
Dalmanella crispata (Emmons)				Ci
Dalmanella electra (Billings)	×			
Dalmanella electra major Matthew	×			
Dalmanella electra lævis Matthew	×			
Dalmanella (?) evadne (Billings)	×			
Dalmanella hamburgensis (Walcott)			T	
Dalmanella macleodi (Whitfield)	×			
Dalmanella (?) plicifera (Hall)		×		
Dalmanella pogonipensis (Hall and Whitfield)	×			
Dalmanella stonensis (Safford)			T	
Dalmanella subæquata (Conrad)			T	
Dalmanella subæquata circularis N. H. Winchell			T	
Dalmanella subæquata conradi N. H. Winchell			T	
Dalmanella subæquata gibbosa Billings		×	BR, T	
Dalmanella subæquata perveta (Conrad)			T	
Dalmanella tersus (Sardeson)				Ci

TABLE IV.—*Ordovician Brachiopoda*—Continued.

Species.	Eoordovician.		Mesoordovician.	Neoordovician.
	Calciferous.	Chazy.	Trenton, Black River, Birdseye.	Cincinnati, Utica.
Dalmanella testudinaria (Dalman)	.....	×	Bi, BR, T	U, Ci
Dalmanella testudinaria emacerata Hall	.....	.....	.....	U
Dalmanella testudinaria meeki (Miller)	.....	.....	.....	Ci
Dalmanella testudinaria multisecta (James) Meek sp	.....	.....	.....	U
Dinobolus canadensis (Billings)	.....	.....	BR, T	.....
Dinobolus magnificus (Billings)	.....	.....	BR, T	.....
Dinobolus (?) parvus Whitfield	.....	.....	T	.....
Dinorthis deflecta Conrad	.....	.....	T	.....
Dinorthis fontinalis (White)	×	.....	.....	.....
Dinorthis iphigenia (Billings)	.....	.....	T	.....
Dinorthis meedsi Winchell and Schuchert	.....	.....	T	.....
Dinorthis meedsi germana Winchell and Schuchert	.....	.....	T	.....
Dinorthis pectinella (Emmons)	.....	.....	T	.....
Dinorthis pectinella sweeneyi N. H. Winchell	.....	.....	T	.....
Dinorthis platys (Billings)	.....	×	.....	.....
Dinorthis porcata (McCoy)	.....	.....	T	Ci
Dinorthis proavita Winchell and Schuchert	.....	.....	.....	Ci
Dinorthis retrorsa (Salter)	.....	.....	T	Ci
Dinorthis subquadrata Hall	.....	.....	.....	Ci
Discina (?) sublamellosa Ulrich	.....	.....	.....	Ci
Eichwaldia subtrigonalis Billings	.....	.....	T	.....
Elkania ambigua (Walcott)	×	.....	.....	.....
Glassia romingeri Hall and Clarke	.....	.....	T	.....
Glossina crassa (Hall)	.....	.....	T	.....
Glossina cyane (Billings)	×	.....	.....	.....
Glossina deflecta Winchell and Schuchert	.....	.....	T	Ci
Glossina hurlbuti N. H. Winchell	.....	.....	T	.....
Glossina trentonensis (Conrad)	.....	.....	T	U
Hebertella battis (Billings)	×	.....	.....	.....
Hebertella bellarugosa (Conrad)	.....	.....	T	.....
Hebertella borealis (Billings)	.....	×	BR, T	.....
Hebertella imperator (Billings)	.....	×	.....	.....
Hebertella insculpta Hall	.....	.....	.....	Ci
Hebertella lonensis (Walcott)	×	.....	.....	.....
Hebertella maria (Billings)	.....	.....	.....	Ci
Hebertella occidentalis Hall	.....	.....	.....	Ci
Hebertella occidentalis sinuata Hall	.....	.....	.....	Ci
Heterorthis clytie Hall	.....	.....	T	.....
Leptæna charlottæ Winchell and Schuchert	.....	.....	T	.....
*Leptæna rhomboidalis (Wilckens)	.....	.....	T	U, Ci
Leptæna unicostata Meek and Worthen	.....	.....	.....	Ci
Leptella sordida (Billings)	×	.....	.....	.....
Leptella decipiens (Billings)	×	.....	.....	.....
Leptobolus grandis Matthew	×	.....	.....	.....
Leptobolus insignis Hall	.....	.....	.....	U
Leptobolus lepis Hall	.....	.....	.....	U
Leptobolus occidentalis Hall	.....	.....	.....	U
Lingula æqualis Hall	.....	.....	T	.....
Lingula belli Billings	.....	×	.....	.....
Lingula beltrami Winchell and Schuchert	.....	.....	.....	Ci
Lingula bisulcata Ulrich	.....	.....	.....	U
Lingula briseis Billings	.....	.....	T	.....

TABLE IV.—*Ordovician Brachiopoda*—Continued.

Species.	Eoordovician.		Mesoordovician.	Neoordovician.
	Calciferous.	Chazy.	Trenton, Black River, Birdseye.	Cincinnati, Utica.
Lingula (?) canadensis Billings			T	Ci
Lingula cincinnatiensis Hall and Whitfield				Ci
Lingula clathrata Winchell and Schuchert			T	
Lingula cobourgensis Billings			T	
Lingula covingtonensis Hall and Whitfield			T	
Lingula curta Conrad			T	U
Lingula (?) dolata Sardeson	×			
Lingula elderi Whitfield			T	Ci
Lingula elongata Hall			T	
Lingula eva Billings			BR	
Lingula forbesi Billings				Ci
Lingula howleyi Matthew	×			
Lingula huronensis Billings		×		
Lingula iole Billings	×			
Lingula iowensis Owen			T	
Lingula iris Billings	×			
Lingula kingstonensis Billings			BR	
Lingula lyelli Billings		×		
Lingula mantelli Billings	×			
Lingula modesta Ulrich			T	U, Ci
Lingula morsi N. H. Winchell		×		
Lingula nympha Billings	×			
Lingula obtusa Hall			T	U
Lingula papillosa Emmons			T	
Lingula perryi Billings		×?		
Lingula philomela Billings			T	C.
Lingula progne Billings			T	U
†Lingula quebecensis Billings	×		T	Ci
Lingula rectilateralis Emmons			T	
Lingula riciniformis Hall			T	
Lingula riciniformis galenensis Winchell and Schuchert			T	
Lingula vanhorni Miller			T	Ci
Lingula whitfieldi Ulrich				Ci
Lingulasma galenensis Winchell and Schuchert			T	
Lingulasma schucherti Ulrich				Ci
Lingulella (?) cuneata Matthew	×			
†Lingulella irene (Billings)	×			
†Lingulella minuta Hall and Whitfield	×			
Lingulella roberti Matthew	×			
Lingulella selwyni Matthew	×			
†Lingulepis (?) mæra Hall and Whitfield	×			
Lingulobolus affinis Billings	×			
Lingulobolus affinis cuneata Matthew	×			
Lingulops norwoodi (James)			T	
Lingulops whitfieldi Hall				U
†Obolella (?) discoidea Hall and Whitfield	×			
†Obolella (?) ida Billings	×			
Orbiculoidea lamellosa Hall			T	Ci
Orbiculoidea tenuistriata (Ulrich)				U
Orthidium gemmicula (Billings)	×			
Orthis (?) acuminata Billings		×		
Orthis carausii Salter	×			

TABLE IV.—*Ordovician Brachiopoda*—Continued.

Species.	Eoordovician.		Mesoordovician.	Neoordovician.
	Calciferous.	Chazy.	Trenton, Black River, Birdseye.	Cincinnati, Utica.
Orthis (?) centrilineata Hall				Ci
Orthis corinna Billings	×			
Orthis costalis Hall		×		
Orthis (?) delicatula Billings	× ?			
Orthis (?) desmopleura Meek	×			
Orthis (?) eudocia Billings	×			
Orthis euryone Billings	×			
Orthis hippolyte Billings	×			
Orthis (?) holstoni (Safford) Hall			T	
Orthis (?) leptænoides Emmons			T	
Orthis menapiæ Hicks	×			
Orthis (?) minna Billings	×			
Orthis (?) morrowensis James				Ci
Orthis (?) mycale Billings	×			
Orthis panderiana Hall	×			
Orthis (?) pigra Billings		×		
Orthis (?) porcia Billings		×		
Orthis (?) pumila Ulrich				Ci
Orthis (?) saffordi Hall and Clarke			T	
Orthis (?) sola Billings				Ci
Orthis tricenaria Conrad			T	
Orthis (?) tritonia Billings	×			
Orthorhynchula linneyi (James)				Ci
Parastrophia divergens Hall and Clarke				Ci
Parastrophia hemiplicata Hall			T	
Parastrophia hemiplicata rotunda (Winchell and Schuchert)			T	
Parastrophia obscura (Hall and Whitfield)	×			
Parastrophia scofieldi (Winchell and Schuchert)			T	
Paterula amii Schuchert	×			
Pholidops cincinnatiensis Hall				Ci
Pholidops subtruncata Hall				Ci
Pholidops trentonensis Hall			T	
Pholidops trentonensis minor Winchell and Schuchert			T	
Platystrophia acuminata James				Ci
Platystrophia acutillirata (Conrad)				Ci
*Platystrophia biforata (Schlotheim)		×	BR, T	U, Ci
Platystrophia crassa (James)				Ci
Platystrophia laticostata Meek				Ci
Platystrophia lynx (Eichwald)				Ci
Plectambonites gibbosa Winchell and Schuchert			T	
Plectambonites plicatella (Ulrich)				U
*Plectambonites sericea (Sowerby)			BR, T	U, Ci
Plectorthis æquivalvis Hall				Ci
Plectorthis dichotoma Hall				Ci
Plectorthis ella Hall				Ci
Plectorthis fissicosta Hall				Ci
Plectorthis jamesi Hall				Ci
Plectorthis kankakensis (McChesney)				Ci
Plectorthis plicatella Hall			T	U, Ci
Plectorthis sectostriata (Ulrich)				Ci
Plectorthis triplicatella (Meek)				Ci

TABLE IV.—*Ordovician Brachiopoda*—Continued.

Species.	Eoordovician.		Mesoordovician.	Neoordovician.
	Calciferous.	Chazy.	Trenton, Black River, Birdseye.	Cincinnati, Utica.
Plectorthis whitfieldi (N. H. Winchell)				Ci
Polytœchia apicalis (Whitfield)	×			
Protorhyncha dubia Hall		×		
Rafinesquina alternata (Conrad) Emmons			BR, T	U, Ci
Rafinesquina alternata alternistriata Hall				Ci
Rafinesquina alternata fracta (Meek)				Ci
Rafinesquina alternata loxorhytis (Meek)				Ci
Rafinesquina alternata nasuta (Conrad)				Ci
Rafinesquina (?) atava (Matthew)	×			
*Rafinesquina ceres (Billings)				Ci
Rafinesquina deltoidea (Conrad)			T	U
Rafinesquina fasciata Hall		×		
Rafinesquina imbrex (Pander)				Ci
Rafinesquina incrassata (Hall)		×	BR	
Rafinesquina kingi (Whitfield)				Ci
Rafinesquina lata Whiteaves				Ci
Rafinesquina mesacosta (Shumard)			T?	
Rafinesquina minnesotensis (N. H. Winchell)			T	
Rafinesquina minnesotensis inquassa (Sardeson)			T	
Rafinesquina nitens (Billings)				Ci
Rafinesquina squamula (James)				U, Ci
Rafinesquina tenuilineata (Conrad)			T	
Rafinesquina ulrichi (James)				U
Retzia (?) granulifera (Meek)				Ci
Rhynchonella (?) acutirostris Hall		×		
Rhynchonella (?) anticostiensis Billings				Ci
Rhynchonella (?) corinthia Billings	×			
*Rhynchonella (?) janea Billings				Ci
Rhynchonella (?) neenah Whitfield				Ci
Rhynchonella (?) orientalis Billings		×		
Rhynchonella (?) sordida Hall			T	
Rhynchonella (?) subtrigonalis Hall			T	
Rhynchotrema ainslæi (N. H. Winchell)			T	
Rhynchotrema capax (Conrad)				Ci
Rhynchotrema dentata (Hall)			T	Ci
Rhynchotrema inæquivalvis (Castelnau)			T	
Rhynchotrema inæquivalvis laticostata Winchell and Schuchert			T	
Rhynchotrema ottawaensis (Billings)			T	
Rhynchotrema periamellosa (Whitfield)				Ci
Scenidium anthonensis Sardeson			T	
Scenidium (?) merope (Billings)			T	Ci
Schizambon (?) dodgii Winchell and Schuchert			T	
Schizambon (?) fissus canadensis Ami				U
Schizambon (?) lockii Winchell and Schuchert				Ci
Schizambon typicalis Walcott	×			
Schizocrania filosa Hall			T	U, Ci
Schizocrania (?) rudis Hall			T	
Schizocrania schucherti Hall and Clarke			T	
Schizotreta conica (Dwight)			T	
Schizotreta minutula Winchell and Schuchert				Ci
Schizotreta ovalis Hall and Clarke			T	

TABLE IV.—*Ordovician Brachiopoda*—Continued.

Species.	Eoordovician.		Mesoordovician.	Neoordovician.
	Calciferous.	Chazy.	Trenton, Black River, Birdseye.	Cincinnati, Utica.
Schizotreta pelopea (Billings)			T	Ci
Siphonotreta (?) micula McCoy	×			
Siphonotreta (?) minnesotensis Hall and Clarke			T	
Sphærobolus spissus Billings	×			
Strophomena approximata (James)				Ci
Strophomena (?) arethusa Billings				Ci
Strophomena billingsi Winchell and Schuchert			T	
Strophomena cardinale (Whitfield)				Ci
Strophomena conradi Hall			T	
Strophomena (?) declivis James				Ci
Strophomena emaciata Winchell and Schuchert			T	
Strophomena fluctuosa Billings				U
Strophomena hallii Miller				Ci
Strophomena hecuba Billings				Ci
Strophomena (?) imbecilis Billings	× ?			
Strophomena incurvata (Shepard)			T	
Strophomena lævis Emmons			Bl	
Strophomena (?) minor (Walcott)	×			
Strophomena neglecta (James)				Ci
Strophomena neglecta acuta Winchell and Schuchert				Ci
Strophomena nutans Meek				Ci
Strophomena planoconvexa Hall				Ci
Strophomena planodorsata Winchell and Schuchert				Ci
Strophomena rugosa (Rafinesque) Blainville				Ci
Strophomena rugosa subtenta Hall				Ci
Strophomena scofieldi Winchell and Schuchert			T	
Strophomena septata Winchell and Schuchert			T	
Strophomena sinuata Meek				Ci
Strophomena sulcata (Verneuil)				Ci
Strophomena thalia Billings			T	
Strophomena trentonensis Winchell and Schuchert			T	
Strophomena trilobata (Owen)			T	
Strophomena vetusta James				Ci
Strophomena winchelli Hall			T	
Strophomena wisconsinensis Whitfield				Ci
Syntrophia lateralis (Whitfield)	×			
Trematis crassipuncta Ulrich				Ci
Trematis (?) dyeri Miller				Ci
Trematis fragilis Ulrich			T	
Trematis huronensis Billings			BR	
Trematis millepunctata Hall				U, Ci
Trematis montrealensis Billings			T	
Trematis oblata Ulrich				U, Ci
Trematis ottawaensis Billings			T	Ci
Trematis punctostriata Hall				Ci
Trematis (?) pustulosa Hall				Ci
Trematis quincuncialis Miller and Dyer				Ci
Trematis reticularis Miller				Ci
Trematis terminalis Emmons			T	
Trematis umbonata Ulrich				Ci
Triplecia cuspidata Hall			T	
Triplecia extans (Emmons)			T	

TABLE IV.—*Ordovician Brachiopoda*—Continued.

Species.	Eoordovician.		Mesoordovician.	Neoordovician.
	Calciferous.	Chazy.	Trenton, Black River, Birdseye.	Cincinnati, Utica.
Triplecia nucleus Hall	.....	.....	T	.....
Triplecia (?) radiata Whitfield	×	.....	.....	.....
Triplecia ulrichi Winchell and Schuchert	.....	.....	.....	Ci
Zygospira cincinnatiensis Meek	.....	.....	.....	Ci
Zygospira concentrica Ulrich	.....	.....	.....	Ci
Zygospira deflecta (Hall)	.....	.....	T	.....
Zygospira exigua (Hall)	.....	.....	T	.....
Zygospira kentuckiensis James	.....	.....	.....	Ci
Zygospira modesta Hall	.....	.....	.....	U, Ci
Zygospira nicoletti Winchell and Schuchert	.....	.....	T	.....
Zygospira putilla Hall and Clarke	.....	.....	.....	Ci
Zygospira recurvirostra (Hall)	.....	.....	T	.....
Zygospira saffordi Winchell and Schuchert	.....	.....	T	.....
Number of Ordovician species, 319.				
Number of species in each division	63	26	128	136
Number of species common to the Calciferous and the other divisions	.....	1	0	1
Number of species common to the Chazy and the other divisions	1	.....	5	2
Number of species common to the Trenton and the other divisions	1	5	.....	27
Number of species common to the Cincinnati and the other divisions	1	2	27	.....
Species common to the Ordovician and Silurian systems, 5.				
Number of species passing from each division into the Silurian	0	1	3	5

TABLE V.—*Silurian Brachiopoda.*

[A = Anticosti; Ar = Arisaig; Cl = Clinton; Gu = Guelph; MS = Mesosilurian; N = Niagara; NS = Neosilurian; Te = Tentaculite and Coralline; W = Waterlime. Species preceded by an asterisk (*) are found in the Devonian also; by an obelisk (†), in the Ordovician.]

Species.	Eosilurian.	Mesosilurian.		Neosilurian.
	Medina.	Anticosti, Clinton.	Guelph, Arisaig, Niagara.	Tentaculite, Waterlime.
Anastrophia brevirostris (Sowerby) Hall			N	
Anastrophia internascens Hall			N	
Anastrophia interplicata (Hall)			N	
Anoplotheca hemispherica (Sowerby)		Cl		
Anoplotheca planoconvexa (Hall)		Cl		
Anoplotheca plicatula (Hall)		Cl		
Athyris (?) solitaria Billings		A		
Athyris (?) tumidula Billings		A		
Athyris (?) turgida Shaler		A		
Atrypa (?) gibbosa Hall		Cl		
Atrypa (?) lara (Billings)		A		
Atrypa laticorrugata Foerste		Cl		
Atrypa marginalis (Dalman)			N	
Atrypa nodostriata Hall		Cl	N	
Atrypa phoca (Salter)			MS	
*Atrypa reticularis (Linnæus)		Cl, A	N	
Atrypa reticularis niagarensis Nettelroth			N	
Atrypa rugosa Hall			N	
Atrypina clintoni Hall and Clarke		Cl		
Atrypina disparilis Hall			N	
Atrypina intermedia Hall			Ar	
Billingsella (?) laurentina (Billings)		A		
Bilobites acutilobus (Ringueberg)			N	
Bilobites bilobus (Linnæus)			N	
Camarella lenticularis Billings		A		
Camarotœchia (?) acinus Hall			N	
Camarotœchia (?) acinus convexa (Foerste)		Cl		
Camarotœchia æquiradiata Hall		Cl		
Camarotœchia fringilla Billings		A		
Camarotœchia glacialis Billings		A		
Camarotœchia (?) indianensis Hall			N	
Camarotœchia (?) neglecta Hall		Cl	N	
Camarotœchia (?) obtusiplicata Hall			N	
Camarotœchia (?) whitii Hall			N	
Capellinia mira Hall and Clarke			N	
Chonetes cornuta Hall		Cl		
Chonetes nova-scotica Hall			Ar, N	
Chonetes striatella (Dalman)			N ?	
Chonetes tenuistriata Hall			Ar	
Chonetes undulata Hall			N	
Clintonella vagabunda Hall and Clarke		Cl		
Clorinda arcuosa (McChesney)			N	
Clorinda areyi (Hall and Clarke)		Cl		
Clorinda barrandii (Billings)		A		
Clorinda fornicata (Hall)		Cl	N	
Clorinda ventricosa (Hall)			N	
Conchidium biloculare Linnæus			MS	
Conchidium colletti Miller				W
Conchidium crassiradiatum (McChesney)			N	

TABLE V.—*Silurian Brachiopoda*—Continued.

Species.	Eosilurian.	Mesosilurian.		Neosilurian.
	Medina.	Anticosti, Clinton.	Guelph, Arisaig, Niagara.	Tentaculite, Waterlime.
Conchidium crassiplicum Hall and Clarke			N	
Conchidium decussatum (Whiteaves)			N	
Conchidium exposeus Hall and Clarke			N	
Conchidium georgiæ Hall and Clarke		Cl		
Conchidium greenii Hall and Clarke			N	
Conchidium knappi (Hall and Whitfield)			N	
Conchidium laqueatum (Conrad)			N	
Conchidium littoni (Hall)			N	
Conchidium multicostatum (Hall)			N	
Conchidium nysius (Hall and Whitfield)			N	
Conchidium obsoletum Hall and Clarke			N	
Conchidium occidentale Hall			Gu	
Conchidium scoparium Hall and Clarke			Gu	
Conchidium tenuicostatum (Hall and Whitfield)			N	
Conchidium unguiforme (Ulrich)			N	
Crania acadiensis Hall			Ar	
Crania anna Spencer			N	
Crania dentata Ringueberg			N	
Crania dubia Foerste		Cl		
Crania gracilis Ringueberg			N	
Crania setifera Hall			N	
Crania siluriana Hall			N	
Crania spinigera Hall			N	
Craniella (?) clintonensis Foerste		Cl		
Cyclospira (?) sparsiplica Foerste		Cl		
Cyrtia exporrecta (Wahlenberg)			N	
Cyrtia meta Hall		Cl	N	
Cyrtia myrtia Billings		A	N	
Cyrtina pyramidalis (Hall)			N	
Dalmanella arcuaria Hall and Clarke			N	
Dalmanella elegantula (Dalman)		Cl	N	
Dalmanella elegantula parva (Foerste)		Cl		
Dalmanella parva de Verneuil		A		
Delthyris (?) rugicosta (Hall)			Ar	
Delthyris sulcata Hisinger			N	
Dictyonella anticostiensis Billings		A		
Dictyonella concinna Hall			N	
Dictyonella corallifera Hall			N	
Dictyonella gibbosa Hall			N	
Dictyonella reticulata Hall			N	
Dinobolus conradi Hall			N	
Glossina perovata (Hall)		Cl		
Gypidula coppingeri (Etheridge)			MS	
Gypidula globosa (Nettelroth)			N	
Gypidula knotti (Nettelroth)			N	
Gypidula nucea (Hall and Whitfield)		Cl		
Gypidula roemeri Hall and Clarke			N	
Gypidula uniplicata (Nettelroth)			N	
Hebertella daytonensis (Foerste)		Cl		
Hebertella fausta (Foerste)		Cl		
Hindella prinstana (Billings)		A		
Hindella umbonata (Billings)		A		

TABLE V.—*Silurian Brachiopoda*—Continued.

Species.	Eosilurian.	Mesosilurian.		Neosilurian.
	Medina.	Anticosti, Clinton.	Guelph, Ariasig, Niagara.	Tentaculite, Waterlime.
Homœospira apriniformis Hall			N	
Homœospira evax Hall			N	
Homœospira sobrina (Beecher and Clarke)			N	
Hyattella congesta (Conrad)		Cl		
Hyatella junia (Billings)		A		
†* Leptæna rhomboidalis (Wilckens)		Cl	N	
Lingula acutirostra Hall		Cl		
Lingula bicarinata Ringueberg			N	
Lingula clintoni Vanuxem		Cl		
Lingula cuneata Conrad	×			
Lingula gibbosa Hall			N	
Lingula ingens Spencer			N	
Lingula insularis Billings		A		
Lingula lamellata Hall			N	
Lingula linguata Hall and Clarke		Cl		
Lingula oblata Hall		Cl		
Lingula subelliptica d'Orbigny		Cl		
Lingula tæniola Hall and Clarke		Cl		
Lingulops granti Hall and Clarke			N	
Meristina maria Hall			N	
Meristina rectirostra Hall			N	
Meristina trisinuata (McChesney)			N	
Mimulus waldronensis (Miller and Dyer)			N	
Monomorella egani Hall and Clarke			N	
Monomorella greenii Hall and Clarke			N	
Monomorella kingi Hall and Clarke			N	
Monomorella newberryi Hall and Whitfield			N	
Monomorella orbicularis Billings			Gu	
Monomorella ortoni Hall and Clarke			N	
Monomorella ovata Whiteaves			Gu	
Monomorella ovata lata Whiteaves			Gu	
Monomorella prisca Billings			Gu	
* Nucleospira elegans Hall			N	
Nucleospira plsiformis Hall			N	
Nucleospira rotundata Whitfield				W
Orbiculoidea numulus Hall and Clarke				W
Orbiculoidea parmulata Hall	×			
Orbiculoidea subplana (Hall)			Ar	
Orbiculoidea vanuxemi (Hall)			Ar	W
Orthis benedicti Miller			N	
Orthis davidsoni de Verneuil		A	N	
Orthis (?) fissiplica Roemer			N	
Orthis flabellites (Hall) Foerste		Cl	N	
Orthis flabellites spania Hall and Clarke			N	
Orthis (?) glypta Hall and Clarke			N	
Orthis (?) missouriensis Shumard			N ?	
Orthis (?) nisis Hall and Whitfield			N	
Orthis (?) punctostriata Hall			N	
Orthis (?) rugiplicata Hall and Whitfield			N	
Orthis (?) ruida Billings		A		
Orthis (?) subnodosa Hall			N	
Orthis (?) tennidens Hall		Cl		

TABLE V.—*Silurian Brachiopoda*—Continued.

Species.	Eosilurian.	Mesosilurian.		Neosilurian.
	Medina.	Anticosti, Clinton.	Guelph, Arisaig, Niagara.	Tentaculite, Waterlime.
Orthis (?) trinucleus Hall	.....	Cl	.....	.....
Orthostrophia (?) fasciata Hall	.....	.....	N	.....
Orthothetes hydraulicum (Whitfield)	.....	.....	.....	W
Orthothetes interstriata (Hall)	.....	.....	.....	Te
*Orthothetes subplana (Conrad)	.....	.....	N	.....
Orthothetes tenuis Hall	.....	.....	N	.....
Orthotropia dolomitica Hall and Clarke	.....	.....	N	.....
Parastrophia greenii Hall and Clarke	.....	.....	N	.....
Parastrophia latiplicata Hall and Clarke	.....	.....	N	.....
Parastrophia multiplicata Hall and Clarke	.....	.....	N	.....
Parastrophia ops (Billings)	.....	A	.....	.....
Parastrophia reversa (Billings)	.....	A	.....	.....
Pentamerella (?) compressa Ringueberg	.....	.....	N	.....
Pentamerus oblongus Sowerby	.....	Cl	N	.....
Pentamerus oblongus cylindricus (Hall and Whitfield)	.....	.....	N	.....
Pentamerus oblongus maquoketa Hall and Clarke	.....	.....	N	.....
Pentamerus oblongus subrectus Hall and Clarke	.....	.....	N	.....
Pentamerus ovalis Hall	.....	Cl	.....	.....
Pentamerus pesovis Whitfield	.....	.....	.....	W
Pholidops ovalis Hall	.....	.....	N	.....
Pholidops squamiformis Hall	.....	.....	N	.....
†Platystrophia biforata (Schlotheim)	.....	Cl	N	.....
Plectambonites glabra Shaler	.....	A	.....	.....
Plectambonites producta Hall and Clarke	.....	.....	N	.....
†Plectambonites sericea (Sowerby)	.....	Cl	.....	.....
Plectambonites transversalis (Wahlenberg)	.....	Cl	N	.....
Plectambonites transversalis alabamensis Foerste	.....	Cl	.....	.....
Plectambonites transversalis prolongata Foerste	.....	Cl	.....	.....
†Rafinesquina ceres (Billings)	.....	A	.....	.....
Rafinesquina (?) obscura (Hall and Clarke)	.....	Cl	.....	.....
Reticularia bicostata (Vanuxem)	.....	.....	N	.....
Reticularia bicostata petila (Hall)	.....	.....	N	.....
Rhinobolus davidsoni Hall and Clarke	.....	.....	N	.....
Rhinobolus galtensis (Billings)	.....	.....	Gu	.....
Rhipidomella circula Hall	.....	Cl	.....	.....
Rhipidomella hybrida (Sowerby)	.....	.....	N	.....
Rhipidomella media (Shaler)	.....	A	.....	.....
Rhipidomella rhynchonelliformis (Shaler)	.....	A	.....	.....
Rhipidomella subcircula (Simpson)	.....	Cl	.....	.....
Rhipidomella ubera (Billings)	.....	A	.....	.....
Rhynchonella (?) argentea Billings	.....	A	.....	.....
Rhynchonella (?) bellaforma Nettelroth	.....	.....	N	.....
Rhynchonella (?) bidens Hall	.....	Cl	.....	.....
Rhynchonella (?) bidentata (Hisinger)	.....	.....	N	.....
Rhynchonella (?) colletti Miller	.....	.....	N	.....
Rhynchonella (?) decemplicata Sowerby	.....	Cl	.....	.....
Rhynchonella (?) emacerata Hall	.....	Cl	Ar	.....
Rhynchonella (?) eva Billings	.....	A	.....	.....
Rhynchonella (?) hydraulica Whitfield	.....	.....	.....	W
†Rhynchonella (?) janea Billings	.....	A	.....	.....
Rhynchonella (?) lævis Simpson	.....	Cl	.....	.....
Rhynchonella (?) lamellata Hall	.....	.....	.....	Te

TABLE V.—*Silurian Brachiopoda*—Continued.

Species.	Ecsilurian.	Mesosilurian.		Neosilurian.
	Medina.	Anticosti, Clinton.	Guelph, Arisaig, Niagara.	Tentaculite, Waterlime.
Rhynchonella (?) nucula (Sowerby)			N	
Rhynchonella (?) nutrix Billings		A		
Rhynchonella (?) pisa Hall and Whitfield			N	
Rhynchonella (?) plicata Hall	×			
Rhynchonella (?) plicatella (Linnæus)			N	
Rhynchonella (?) pyrrha Billings		A		
Rhynchonella (?) robusta Hall		Cl		
Rhynchonella (?) rugæcosta Nettelroth			N	
Rhynchonella (?) tennesseensis Roemer			N	
Rhynchonella (?) vicina Billings		A		
Rhynchospira (?) acadiæ (Hall)			Ar	
Rhynchospira (?) helena (Nettelroth)			N	
Rhynchospira (?) sinuata Hall			Ar	
Rhynchotreta cuneata americana Hall			N	
Scenidium pyramidale Hall			N	
Schizophoria senecta Hall and Clarke		Cl		
Schizotreta tenuilamellata Hall			N	
Spirifer asperatus Ringueberg			N	
Spirifer crispatus Hall and Clarke			N	
Spirifer crispus (Hisinger)			N	Te
Spirifer crispus simplex Hall			N	
Spirifer dubius Nettelroth			N?	
Spirifer eudorus Hall			N	
Spirifer foggi Nettelroth			N	
Spirifer gibbosus Hall			N	
Spirifer niagarensis (Conrad)			N	
Spirifer niagarensis oligoptychus Roemer			N	
Spirifer nobilis Barrande			N	
Spirifer radiatus Sowerby		Cl	N	
Spirifer rostellum Hall and Whitfield			N	
Spirifer similior Winchell and Marcy			N	
Spirifer subsulcatus Hall			Ar	
Spirifer vanuxemi Hall				Te
Streptis grayi Davidson			N	
Stricklandinia anticostiensis Billings		A		
Stricklandinia billingsana Dawson			Ar	
Stricklandinia brevis Billings		A		
Stricklandinia canadensis Billings		Cl		
Stricklandinia castellana White			N	
Stricklandinia chapmani Hall and Clarke			N	
Stricklandinia davidsoni Billings		A		
Stricklandinia deformis Meek and Worthen			N	
Stricklandinia gaspensis Billings			N	
Stricklandinia lens (Sowerby)			N?	
Stricklandinia lirata Billings		A		
Stricklandinia (?) louisvillensis Nettelroth			N	
Stricklandinia melissa Billings		A		
Stricklandinia multilirata Whitfield			Gu	
Stricklandinia salteri Billings		A		
Stricklandinia triplesiana Foerste		Cl		
Stropheodonta acanthoptera (Whiteaves)			N?	
Stropheodonta corrugata Conrad		Cl		

TABLE V.—*Silurian Brachiopoda*—Continued.

Species.	Eosilurian.	Mesosilurian.		Neosilurian.
	Medina.	Anticosti, Clinton.	Guelph, Arisaig, Niagara.	Tentaculite, Waterlime.
Strophedonta corrugata pluristriata Foerste	.....	Cl	.....	.....
Strophedonta (?) geniculata (Shaler)	.....	A	.....	.....
Strophedonta (?) gilpeni (Dawson)	.....	.....	Ar	.....
Strophedonta leda (Billings)	.....	A	.....	.....
Strophedonta macra (Winchell and Marcy)	.....	.....	N	.....
Strophedonta nearpassi Barrett	.....	.....	.....	Te
Strophedonta prisca Hall	.....	Cl	.....	.....
Strophedonta profunda Hall	.....	Cl	N	.....
Strophedonta textilis Hall	.....	.....	.....	Te
Strophedonta (?) ventricosa (Shaler)	.....	A	.....	.....
Strophomena (?) alterniradiata Shaler	.....	A	.....	.....
Strophomena (?) antiquata Sowerby	.....	A	.....	.....
Strophomena (?) arcuata Shaler	.....	A	.....	.....
Strophomena (?) bipartita Hall	.....	.....	.....	Te
Strophomena (?) doneti Salter	.....	.....	MS	.....
Strophomena (?) eliptica Conrad	.....	.....	N	.....
Strophomena (?) julia Billings	.....	A	.....	.....
Strophomena (?) modesta Conrad	.....	Cl?	.....	.....
Strophomena (?) orthididea Hall	.....	Cl	.....	.....
Strophomena philomela Billings	.....	A	.....	.....
Strophomena (?) reticulata Shaler	.....	.....	N	.....
Strophomena (?) semiovalis Shaler	.....	A	.....	.....
Strophomena (?) siluriana Davidson	.....	.....	N	.....
Strophonella costatula Hall and Clarke	.....	.....	N	.....
Strophonella (?) patenta Hall	.....	Cl	.....	.....
Strophonella semiplicata Hall	.....	.....	N	.....
Strophonella striata Hall	.....	.....	N	.....
Trematospira camura Hall	.....	.....	N	.....
Trimerella acuminata Billings	.....	.....	Gu	.....
Trimerella billingsi Dall	.....	.....	Gu	.....
Trimerella dalli Davidson and King	.....	.....	Gu	.....
Trimerella grandis Billings	.....	.....	Gu	.....
Trimerella ohioensis Meek	.....	.....	N	.....
Triplecia niagarensis Hall and Clarke	.....	.....	N	.....
Triplecia ortoni Meek	.....	Cl	.....	.....
Uncinulus stricklandi (Sowerby)	.....	.....	N	.....
Whitfieldella billingsana (Meek and Worthen)	.....	.....	N	.....
Whitfieldella cylindrica Hall	.....	Cl	N	.....
Whitfieldella hyale (Billings)	.....	.....	Gu	.....
Whitfieldella intermedia (Hall)	.....	Cl	N	.....
Whitfieldella (?) julia (Billings)	.....	A	.....	.....
Whitfieldella (?) naviformis (Hall)	.....	Cl	N	.....
Whitfieldell nitida Hall	.....	.....	N	.....
Whitfieldella nitida oblata Hall	.....	.....	N	.....
Whitfieldella (?) nucleolata (Hall)	.....	.....	.....	Te
Whitfieldella oblata (Hall)	×	.....	.....	.....
Whitfieldella sulcata (Vanuxem)	.....	.....	.....	W
Wilsonia kokomoensis (Miller)	.....	.....	.....	W
* Wilsonia saffordi Hall	.....	.....	N	.....
Wilsonia saffordi depressa Nettelroth	.....	.....	N	.....
Wilsonia wilsoni (Sowerby)	.....	.....	N	.....
Zygospira (?) mica (Billings)	.....	A	.....	.....

TABLE V.—*Silurian Brachiopoda*—Continued.

Species.	Eosilurian.	Mesosilurian.		Neosilurian.
	Medina.	Anticosti, Clinton.	Guelph, Arisaig, Niagara.	Tentaculite, Waterlime.
Zygospira (?) minima Hall	.....	.....	N	.....
Zygospira (?) paupera Billings	.....	A	.....	.....
Number of Silurian species, 311.				
Number of species in each division	4	116	195	17
Number of species common to the Medina and the other divisions	0	0	0	0
Number of species common to the Clinton and the other divisions	0	.....	19	0
Number of species common to the Niagara and the other divisions	0	19	.....	2
Number of species common to the Neosilurian and the other divisions	0	0	2	.....
Species common to the Silurian and Devonian systems, 5.				
Number of species passing from each division into the Devonian	0	2	5	0

TABLE VI.—*Devonian Brachiopoda.*

[C=Chemung; Co=Corniferous; ED=Eodevonian; G=Genesee; H=Hamilton; Hu=Huron; I=Ithaca; M=Marcellus; MD=Mesodevonian; ND=Neodevonian; P=Portage; S=Schoharie; Tu=Tully. Species preceded by an asterisk (*) are found in the Carboniferous also; by an obelisk (†), in the Silurian.]

Species.	Eodevonian.		Mesodevonian.		Neodevonian.	
	Lower Helderberg.	Oriskany.	Schoharie, Corniferous.	Tully, Hamilton, Marcellus.	Portage, Huron, Genesee.	Chemung, Ithaca.
Amboccelia fimbriata Claypole	.....	.....	.....	.....	P	.....
Amboccelia gregaria Hall	.....	.....	.....	.....	.....	C
Amboccelia præumbona Hall	.....	.....	.....	H	.....	.....
Amboccelia spinosa Hall and Clarke	.....	.....	.....	H	.....	.....
Amboccelia umbonata (Conrad)	.....	.....	Co	M, H	G	I, C
Amphigenia curta (Meek and Worthen)	.....	×	.....	.....	.....	.....
Amphigenia elongata (Vanuxem)	.....	×	Co	.....	.....	.....
Amphigenia elongata subtrigonalis Hall	.....	.....	Co	.....	.....	.....
Amphigenia elongata undulata Hall	.....	.....	Co	.....	.....	.....
Anastrophia verneuili (Hall)	×	.....	.....	.....	.....	.....
Anoplia nucleata Hall	.....	×	Co	.....	.....	.....
Anoplotheca acutiplicata (Conrad)	.....	×	Co	.....	.....	.....
Anoplotheca camilla (Hall)	.....	×	Co	M	.....	.....
Anoplotheca concava (Hall)	×	.....	.....	.....	.....	.....
Anoplotheca dichotoma (Hall)	.....	×	.....	.....	.....	.....
Anoplotheca fimbriata (Hall)	.....	×	.....	.....	.....	.....
Anoplotheca fiabellites (Conrad)	.....	×	Co	.....	.....	.....
Anoplotheca infrequens (Walcott)	ED	.....	.....	.....	ND	.....
Athyris angelica Hall	.....	.....	.....	.....	.....	C
Athyris angelica occidentalis Whiteaves	.....	.....	.....	H	.....	.....
Athyris brittsi Miller	.....	.....	.....	MD	.....	.....
Athyris cora Hall	.....	.....	.....	H	.....	C?
Athyris fultonensis (Swallow)	.....	.....	Co	H	.....	.....
Athyris minutissima Webster	.....	.....	.....	.....	.....	C
Athyris (?) ottervillensis Miller	.....	.....	.....	MD	.....	.....
Athyris parvula Whiteaves	.....	.....	.....	H	.....	.....
Athyris polita Hall	.....	.....	.....	.....	.....	C
Athyris spiriferoides (Eaton)	.....	.....	Co	H	.....	.....
Atrypa desquamata Sowerby	.....	.....	.....	H	.....	.....
Atrypa ellipsoidea Nettelroth	.....	.....	Co	.....	.....	.....
Atrypa hystrix Hall	.....	.....	.....	.....	.....	C
Atrypa hystrix elongata Webster	.....	.....	.....	.....	.....	C
Atrypa hystrix occidentalis Hall	.....	.....	.....	MD	.....	.....
Atrypa hystrix planosulcata Webster	.....	.....	.....	.....	.....	C
Atrypa missouriensis Miller	.....	.....	.....	MD	.....	.....
Atrypa pseudomarginalis Hall	.....	.....	S	.....	.....	.....
†Atrypa reticularis (Linnæus)	×	.....	Co, S	H, Tu	.....	I, C
Atrypa reticularis impressa Hall	.....	.....	S	.....	.....	.....
Atrypa reticularis nuntia Hall and Whitfield	.....	.....	.....	H	.....	.....
Atrypa reticularis ventricosa Hall and Whitfield	.....	.....	.....	H	.....	.....
Atrypa spinosa Hall	.....	.....	Co	H	.....	C
Atrypina imbricata Hall	×	.....	.....	.....	.....	.....
Barroisella subspatulata (Meek and Worthen)	.....	.....	.....	.....	G	.....
Beachia sucssana Hall	.....	×	.....	.....	.....	.....
Bilobites varicus (Conrad)	×	.....	.....	.....	.....	.....
Camarophoria rhomboidalis Hall and Clarke	.....	.....	Co	.....	.....	.....
Camarospira eucharis Hall	.....	.....	Co	.....	.....	.....
Camarotœchia barrandi Hall	.....	×	.....	.....	.....	.....

TABLE VI.—*Devonian Brachiopoda*—Continued.

Species.	Eodevonian.		Mesodevonian.		Neodevonian.	
	Lower Helderberg.	Oriskany.	Schoharie, Corniferous.	Tully, Hamilton, Marcellus.	Portage, Huron, Genesee.	Chemung, Ithaca.
Camarotœchia billingsi Hall			Co			
Camarotœchia carica Hall				H		
Camarotœchia carolina Hall			Co			
Camarotœchia congregata (Conrad)				H		
*Camarotœchia contracta Hall					P	C
Camarotœchia contracta saxatilis Hall				H		
Camarotœchia dotis Hall				M, H		
Camarotœchia duplicata Hall						C
Camarotœchia endlichi (Meek). ? Devonian.						
Camarotœchia eximia Hall					P	I, C
Camarotœchia horsfordi Hall				M, H		
Camarotœchia orbicularis Hall						C
Camarotœchia pleiopleura (Conrad)		×				
Camarotœchia prolifica Hall				M, H		
*Camarotœchia sappho Hall				M, H		C
Camarotœchia speciosa Hall		×				
Camarotœchia stephani Hall					P	C
Camarotœchia tethys (Billings)			Co			
Camarotœchia ventricosa Hall	×					
Centronella alveata Hall			Co			
Centronella glansfagea Hall		×	Co			
Centronella glaucia Hall				H		
Centronella impressa Hall				H		
Centronella (?) navicella (Hall)						C
Centronella ovata Hall			Co			
Centronella tumida Billings		×	Co			
Charionella scitula Hall			Co			
Chonetes acutiradiata Hall			Co			
Chonetes antiope Billings		×?				
Chonetes arcuata Hall			Co			
Chonetes canadensis Billings		×?				
Chonetes coronata (Conrad)				H		
Chonetes emmetensis A. Winchell				H		
Chonetes filistriata Walcott		ED				
Chonetes hemispherica Hall			Co			
Chonetes koninckiana Norwood and Pratten				MD		
Chonetes lepida Hall				M, H	G, P	I, C
Chonetes lineata (Conrad)			Co	M		
*Chonetes logani aurora Hall				Tu		
Chonetes manitobensis Whiteaves						ND
Chonetes melonica Billings		×				
Chonetes mucronata Hall		×	Co	M, H		
Chonetes punctata Simpson	×					
Chonetes pusilla Hall				H		
Chonetes scitula Hall				M, H	P	I, C
* Chonetes setigera (Hall)				M, H	G	C
Chonetes subquadrata Nettelroth				H		
Chonetes vicina (Castelnau)				H		
Chonetes yandellana Hall			Co			
Chonostrophia complanata Hall		×				
Chonostrophia dawsoni (Billings)		×?				

TABLE VI.—*Devonian Brachiopoda*—Continued.

Species.	Eodevonian.		Mesodevonian.		Neodevonian.	
	Lower Helderberg.	Oriskany.	Schoharie, Cornif. erous.	Tully, Hamilton, Marcellus.	Portage, Huron, Genesee.	Chemung, Ithaca.
Chonostrophia helderbergiæ Hall	×					
Chonostrophia reversa (Whitfield)			Co			
Christiania subquadrata Hall	×					
Conchidium knighti Nettelroth			Co?			
Conchidium (?) salienense (Swallow)				H?		
Cranæna iowensis (Calvin)				MD		
Cranæna romingeri Hall				H		
Crania agaricina Hall and Clarke	×					
Crania aurora Hall			S			
Crania bella Billings		× ?				
Crania centralis Hall					P	
Crania cremistriata Hall			Co	H		
Crania famelica Hall and Whitfield				H		
Crania favincola Hall and Clarke				MD		
Crania grancsa Hall and Clarke				H		
Crania greenii Miller			Co			
Crania leoni Hall					P	C
Crania pulchella Hall and Clarke	×					
Crania sheldoni White				H		
Craniella hamiltoniæ Hall				M, H		
Cryptonella (?) circula Walcott. Devonian.						
Cryptonella (?) eudora Hall						I, C
Cryptonella (?) eximia Hall	×					
Cryptonella iphis Hall			Co			
Cryptonella lens Hall			Co			
Cryptonella ovalis Miller				H		
Cryptonella pinonensis Walcott						ND
Cryptonella planirostra Hall				M, H		
Cryptonella rectirostra Hall				H		
Cyclorhina nobilis Hall				H		
Cyrtia cyrtinaformis Hall and Whitfield						C
Cyrtia norwoodi (Meek)				MD		
Cyrtina affinis Billings		×				
Cyrtina billingsi Meek				H		
Cyrtina biplicata Hall			Co			
Cyrtina crassa Hall			Co			
Cyrtina curvilineata White				H		
Cyrtina dalmani Hall	×					
Cyrtina davidsoni Walcott				MD		ND
Cyrtina hamiltonensis Hall			Co	H	P	I
Cyrtina hamiltonensis recta Hall				H		C
Cyrtina missouriensis (Swallow)				H		
Cyrtina (?) occidentalis (Swallow)				H		
Cyrtina rostrata (Hall)		×	Co			
Cyrtina tiquetra (Hall)				H		
Cyrtina umbonata (Hall)				H		
Cyrtina umbonata alpenensis Hall and Clarke				H		
Dalmanella concinna (Hall)	×					
Dalmanella devonica (Walcott)		ED				
Dalmanella infera (Calvin)						C
Dalmanella lenticularis (Vanuxem)			Co			

TABLE VI.—*Devonian Brachiopoda*—Continued.

Species.	Eodevonian.		Mesodevonian.		Neodevonian.	
	Lower Helderberg.	Oriskany.	Schoharie, Corniferous.	Tully, Hamilton, Marcellus.	Portage, Huron, Genesee.	Chemung, Ithaca.
Dalmanella lepida Hall				H		
Dalmanella perelegans Hall	×	×				
Dalmanella planoconvexa Hall	×	×				
Dalmanella quadrans Hall	×					
Dalmanella subcarinata Hall	×					
Dalmanella superstes Hall and Clarke						C
Dalmanella tenuilineata Hall						C
Delthyris consobrina (d'Orbigny)				H		
Delthyris mesacostalis Hall						I, C
Delthyris perlamellosa (Hall)	×					
Delthyris raricosta Conrad			Co			
Delthyris sculptilis Hall				H		
Dielasma calvini Hall and Whitfield						C
Dignomia alveata Hall				H		
Eatonia coulteri Miller and Gurley		×				
Eatonia eminens Hall	×					
Eatonia medialis (Vanuxem)	×	×				
Eatonia peculiaris (Conrad)	×	×				
Eatonia pumila Hall		×				
Eatonia singularis (Vanuxem)	×					
Eatonia sinuata Hall		×				
Eatonia (?) variabilis Whiteaves				H		
Eatonia whitfieldi Hall		×				
Eunella harmonia Hall			Co			
Eunella lincklæni Hall				M, H		
Eunella simulator Hall				H		
Eunella sullivanti Hall			Co			
Glossina leana (Hall)				H		
Glossina spatiosa (Hall)	×					
Glossina triangulata (Nettelroth)				H		
Gypidula comis (Owen)				MD		
Gypidula galeata (Dalman)	×					
Gypidula læviuscula Hall				MD		
Gypidula lotis (Walcott)						ND
Gypidula munda Calvin				MD		
Gypidula pseudogaleata (Hall)	×					
Gypidula romingeri Hall and Clarke				H		
Gypidula subglobosa (Meek and Worthen)				H		
Hipparionyx proximus Vanuxem		×				
Hypothyris castanea (Meek)				MD		
Hypothyris cuboides (Sowerby)				Tu		
Hypothyris emmonsi (Hall and Whitfield)				MD		
Leiorhynchus dubium Hall				M		
Leiorhynchus globuliforme (Vanuxem)						C
Leiorhynchus hecate Clarke					G	
Leiorhynchus iris Hall						C
Leiorhynchus kelloggi Hall				H		
Leiorhynchus laura Billings				M, H		
Leiorhynchus lesleyi Hall and Clarke						ND
Leiorhynchus limitare (Vanuxem)				M		
Leiorhynchus mesacostale Hall					P	I, C

TABLE VI.—*Devonian Brachiopoda*—Continued.

Species.	Eodevonian.		Mesodevonian.		Neodevonian.	
	Lower Helderberg.	Oriskany.	Schoharie, Corniferous.	Tully, Hamilton, Marcellus.	Portage, Huron, Genesee.	Chemung, Ithaca.
Leiorhynchus mysia Hall				M		
Leiorhynchus nevadense Walcott				MD		
Leiorhynchus quadricostatum (Vanuxem)				M	G	
Leiorhynchus robustum Hall and Clarke						C
Leiorhynchus sesquiplicatum A. Winchell				H		
Leiorhynchus sinuatum Hall						C
[*]Leptæna rhomboidalis (Wilckens)	×	×	Co	H		C
Leptæna rhomboidalis ventricosa Hall		×				
Leptænisca adnascens Hall and Clarke	×					
Leptænisca concava Hall	×					
Leptænisca tangens Hall	×					
Lindstrœmella aspidium Hall				H		
Lingula albapinensis Walcott						ND
Lingula artemis Billings		× ?				
Lingula centrilineata Hall	×					
Lingula ceryx Hall			S			
Lingula complanata Williams				H		I
Lingula compta Hall and Clarke				H		
Lingula concentrica Conrad			Co ?			
*Lingula cuyahoga Hall						C
Lingula delia Hall				H		
Lingula densa Hall				H		
Lingula desiderata Hall			Co			
Lingula ligea Hall				H	P	
Lingula ligea nevadensis Walcott		ED				
Lingula lonensis Walcott		ED				
Lingula lucretia Billings		× ?				
Lingula maida Hall				H		
Lingula manni Hall			Co			
Lingula minuta Meek				H		
Lingula nuda Hall				H		
Lingula perlata Hall	×					
Lingula punctata Hall				H		I
Lingula rectilatera Hall	×					
Lingula scutella Hall and Clarke						C
Lingula spathata Hall	×					
Lingula spatulata Vanuxem				H	G, P	I
Lingula thedfordensis Whiteaves				H		
Lingula triquetra Clarke					P	
Lingula whitii Walcott		ED				
Lingulella (?) paliformis Hall				H		
Lingulodiscina exilis (Hall)				M		
Lissopleura æquivalvis (Hall)	×					
Martinia athyroides A. Winchell				H		
Martinia glanceraai (White)				H		
Martinia (?) insolita A. Winchell					Hu	
Martinia maia (Billings)			Co			
Martinia meristoides Meek				H		
Martinia sublineata Meek				H		
Martinia subumbona (Hall)				M, H	P	
Megalanteris condoni (McCheaney)		×				

TABLE VI.—*Devonian Brachiopoda*—Continued.

Species.	Eodevonian.		Mesodevonian.		Neodevonian.	
	Lower Helderberg.	Oriskany.	Schoharie, Corniferous.	Tully, Hamilton, Marcellus.	Portage, Huron, Genesee.	Chemung, Ithaca.
Megalanteris ovalis Hall		×				
Merista elongata Hall	×					
Merista tennesseensis Hall	×					
Merista typa Hall	×					
Meristella arcuata Hall	×					
Meristella barrisi Hall				M, H		
Meristella bella (Hall)	×					
Meristella (?) blancha (Billings)	×					
Meristella clusia (Billings)			Co			
Meristella doris Hall			Co			
Meristella haskinsi Hall				H		
Meristella (?) houghtoni (A. Winchell)					Hu	
Meristella lævis (Vanuxem)	×					
Meristella lata Hall		×				
Meristella lens (A. Winchell)				H		
Meristella lenta Hall		×				
Meristella meeki Hall	×					
Meristella meta Hall				H		
Meristella nasuta (Conrad)			Co			
Meristella princeps Hall	×					
Meristella rostrata Hall				H		
Meristella subquadrata (Hall)	×					
Meristella walcotti Hall and Clarke		×				
Metaplasia disparilis (Hall)			Co			
Metaplasia pyxidata (Hall)		×				
Newberria claypoli Hall				H		
Newberria johannis Hall				MD		
Newberria lævis (Meek)				H		
Newberria missouriensis Hall				H		
Nucleospira concentrica Hall	×					
Nucleospira concinna Hall			Co	H		
Nucleospira elegans Hall	×					
Nucleospira ventricosa Hall	×					
Orbiculoidea alleghania (Hall)						C
Orbiculoidea ampla Hall		×				
Orbiculoidea conradi (Hall)	×					
Orbiculoidea discus Hall	×					
Orbiculoidea doria (Hall)				H		
Orbiculoidea elmira (Hall)						C
Orbiculoidea humilis (Hall)				M, H		
Orbiculoidea jervensis (Barrett)		×				
Orbiculoidea lodensis (Vanuxem)					G	
Orbiculoidea lodensis media Hall				M, H		C
Orbiculoidea marginalis (Whitfield)				H		
Orbiculoidea minuta Hall				M, H		
Orbiculoidea neglecta (Hall)						C
Orbiculoidea randalli Hall				H		
Orbiculoidea seneca (Hall)				H		
Orbiculoidea tullia (Hall)				Tu		
Oriskania navicella Hall and Clarke		×				
Orthis (?) eryna Hall			Co			

TABLE VI.—*Devonian Brachiopoda*—Continued.

Species.	Eodevonian.		Mesodevonian.		Neodevonian.	
	Lower Helderberg.	Oriskany.	Schoharie, Corniferous.	Tully, Hamilton, Marcellus.	Portage, Huron, Genesee.	Chemung, Ithaca.
Orthis (?) tenuistriata Hall					P	
Orthostrophia strophomenoides Hall	×					
Orthothetes anomala (A. Winchell)				H		
Orthothetes bellulus Clarke				M		
Orthothetes chemungensis (Conrad)						C
Orthothetes chemungensis arctostriata Hall				M, H	P	
Orthothetes chemungensis perversus Hall			Co	H		
Orthothetes deformis Hall	×					
Orthothetes deformis sinuata Hall and Clarke	×					
Orthothetes flabellum (Whitfield)			Co			
Orthothetes pandora (Billings)			Co	M		
Orthothetes prava Hall						ND?
Orthothetes subplana (Conrad)	×					
Orthothetes woolworthana Hall	×					
Parazyga deweyi Hall	×					
Parazyga hirsuta Hall			Co	H		
Pentagonia unisulcata (Conrad)		×	Co	H		
Pentamerella arata (Conrad)			Co			
Pentamerella borealis (Meek)				H		
Pentamerella dubia Hall				H?		
Pentamerella intralineata (A. Winchell)				H		
Pentamerella micula Hall				H?		
Pentamerella obsolescens Hall				H?		
Pentamerella pavillionensis Hall				H		
Pentamerella thusnelda Nettelroth			Co			
Pholidops arenaria Hall		×				
Pholidops areolata Hall			S			
Pholidops bellula Walcott		ED				
Pholidops calceola Hall and Clarke			Co			
Pholidops greenii Miller and Gurley				H		
Pholidops hamiltoniæ Hall				H		
Pholidops lepis Hall and Clarke			Co			
Pholidops oblata Hall				H		
Pholidops ovata Hall	×					
Pholidops patina Hall and Clarke			Co			
Pholidops quadrangularis Walcott		ED				
Pholidops terminalis Hall		×				
Pholidostrophia iowensis (Owen)			Co	H		
Plectorthis (?) aurelia (Billings)		×				
Productella arctirostrata Hall						C
Productella bialveata Hall						C
Productella boydi Hall						C
Productella costatula Hall						C
Productella costatula strigata Hall						C
Productella dumosa Hall				H		
Productella eriensis Nicholson			Co			
Productella exanthemata Hall			Co	H		
Productella hallana Walcott						ND
Productella hirsuta Hall						C
Productella hirsuta rectispina Hall						C
Productella hirsutiforme (Walcott)						ND

TABLE VI.—*Devonian Brachiopoda*—Continued.

Species.	Eodevonian.		Mesodevonian.		Neodevonian.	
	Lower Helderberg.	Oriskany.	Schoharie, Corniferous.	Tully, Hamilton, Marcellus.	Portage, Huron, Genesee.	Chemung, Ithaca.
Productella lachrymosa (Conrad)						C
Productella lachrymosa lima (Conrad)						C
*Productella lachrymosa stigmata Hall						C
Productella marquessi Rowley				H		
Productella murchisoniana De Koninck				H		
Productella navicella Hall			Co	H		
Productella onusta Hall						C
Productella papulata Hall				H		
Productella productoides (Murchison)				H		
Productella rarispina Hall						C
Productella semiglobosa Nettelroth			Co			
*Productella speciosa Hall					P	I, C
Productella spinulicosta Hall			Co	M, H		
Productella striatula Hall						C
Productella subalata Hall				MD		
Productella tullia Hall				H		
Pugnax pugnus Martin					P	I
Pugnax pugnus altus (Calvin)						ND
Rensselæria æquiradiata (Conrad)	×					
Rensselæria cayuga Hall and Clarke		×				
Rensselæria cumberlandiæ Hall		×				
Rensselæria elliptica Hall	×					
Rensselæria intermedia Hall		×				
Rensselæria marylandica Hall		×				
Rensselæria mutabilis Hall	×					
Rensselæria ovoides (Eaton)		×				
Rensselæria ovalum Hall and Clarke		×				
Reticularia canandaiguæ (Hall and Clarke)				H		
Reticularia fimbriata (Conrad)		×	Co	M, H		I
Reticularia franklini (Meek)				H		
Reticularia knappiana (Nettelroth)			Co			
Reticularia lævis (Hall)					P	I
Reticularia modesta (Hall)	×	×				
Reticularia nevadensis (Walcott)						ND
Reticularia (?) nympha (Billings)	×					
Reticularia prænatura (Hall)						C
Reticularia subundifera (Meek and Worthen)				H		
Retzia (?) polypleura A. Winchell					P	
Retzia (?) subglobosa Hall			S			
Rhipidomella alsa Hall			S			
Rhipidomella assimilis Hall	×					
Rhipidomella cleobis Hall			Co			
Rhipidomella cumberlandiæ Hall		×				
Rhipidomella (?) cuneata (Owen)				H		
Rhipidomella cyclas Hall				M, H		
Rhipidomella discus Hall	×					
Rhipidomella eminens Hall	×					
Rhipidomella goodwini (Nettelroth)				H		
Rhipidomella idonea Hall				H		
Rhipidomella leucosia Hall				H		
Rhipidomella livia (Billings)			Co			
Rhipidomella lucia Billings		×				

TABLE VI.—*Devonian Brachiopoda*—Continued.

Species.	Eodevonian.		Mesodevonian.		Neodevonian.	
	Lower Helderberg.	Oriskany.	Schoharie, Cornif-erous.	Tully, Hamilton, Marcellus.	Portage, Huron, Genesee.	Chemung, Ithaca.
Rhipidomella (?) mitis (Hall)			S			
Rhipidomella musculosa Hall		×				
Rhipidomella oblata Hall	×					
Rhipidomella oblata emarginata Hall	×					
Rhipidomella peloris Hall			S			
Rhipidomella penelope Hall				H		
Rhipidomella pennsylvanica (Simpson)						C
Rhipidomella semele Hall			Co			
Rhipidomella solitaria Hall				H		
Rhipidomella suborbicularis Hall				H		
*Rhipidomella thiemii (White)						C
Rhipidomella tubulostriata Hall	×					
Rhipidomella vanuxemi Hall			Co	M, H		
Rhynchonella acutiplicata Hall	×					
Rhynchonella allegania Williams						C
Rhynchonella altiplicata Hall	×					
Rhynchonella ambigua Calvin				MD		
Rhynchonella aspasia Billings	×					
Rhynchonella bialveata Hall	×					
Rhynchonella dryope Billings		×				
Rhynchonella eminens Hall	×					
Rhynchonella excellens Billings		×				
Rhynchonella fitchana Hall		×				
Rhynchonella gainesi Nettelroth				H		
Rhynchonella huronensis A. Winchell					Hu	
Rhynchonella huronensis precipua A. Winchell					Hu	
Rhynchonella inaequiplicata Hall			Co			
Rhynchonella inutilis Hall	×					
Rhynchonella louisvillensis Nettelroth			Co			
Rhynchonella mainensis Billings	×					
Rhynchonella medea Billings			Co			
Rhynchonella multistriata Hall		×				
Rhynchonella oblata Hall		×				
Rhynchonella occidens Walcott		ED				
Rhynchonella planoconvexa Hall	×					
Rhynchonella principalis Hall		×				
Rhynchonella ramsayi Hall		×				
Rhynchonella raricosta Whitfield			Co			
Rhynchonella royana Hall			Co			
Rhynchonella rudis Hall	×					
Rhynchonella semiplicata (Conrad)	×					
Rhynchonella septata Hall		×				
Rhynchonella subacuminata Webster						C
Rhynchonella sulcoplicata Hall	×					
Rhynchonella tenuistriata Nettelroth			Co			
Rhynchonella transversa Hall	×					
Rhynchonella warrenensis Swallow		ED				
Rhynchospira electra Billings	×					
Rhynchospira (?) eugenia Billings			Co			
Rhynchospira formosa Hall	×					
Rhynchospira globosa Hall	×					

TABLE VI.—*Devonian Brachiopoda*—Continued.

Species.	Eodevonian.		Mesodevonian.		Neodevonian.	
	Lower Helderberg.	Oriskany.	Schoharie, Corniferous.	Tully, Hamilton, Marcellus.	Portage, Huron, Genesee.	Chemung, Ithaca.
Rhynchospira rectirostra Hall		×				
Rhynchotrema formosa (Hall)	×					
Rœmerella grandis Vanuxem				H		
Scenidium insignis Hall	×					
Schizobolus concentricus (Vanuxem)					G	
Schizocrania (?) helderbergia Hall	×					
Schizocrania superincreta Barrett	×					
Schizophoria carinata Hall						C
Schizophoria macfarlanii (Meek)				MD		ND
Schizophoria manitobensis Whiteaves						ND
Schizophoria multistriata Hall	×					
Schizophoria (?) peduncularis Hall	×					
Schizophoria propinqua Hall			Co			
Schizophoria striatula (Schlotheim)				MD		ND
Schizophoria tioga Hall					P	C
Schizophoria tulliensis (Vanuxem)				Tu		
Selenella gracilis Hall and Clarke			Co			
Seminula (?) rogersi Hall and Clarke			Co			
Spirifer acanthopterus (Conrad)				H		
Spirifer acuminatus (Conrad)			Co	H		
Spirifer alæformis de Verneuil			Co			
Spirifer aldrichi Etheridge. Devonian.						
Spirifer amarus Swallow				H		
Spirifer angustus Hall				H	P	
Spirifer annæ Swallow				H		
Spirifer arcticus Haughton. Devonian.						
Spirifer arctisegmentus Hall			Co			
Spirifer arenosus Conrad		×	Co			
Spirifer asper Hall				H		
Spirifer audaculus (Conrad)				M, H		
Spirifer audaculus macronotus Hall				H		
Spirifer belphegor Clarke					G	
Spirifer bidorsalis A. Winchell				H		
Spirifer billingsanus Miller		×				
Spirifer bimesialis Hall						ND
Spirifer byrnesi Nettelroth				H		
Spirifer concinnus Hall	×					
Spirifer consors A. Winchell				H		
Spirifer corticosus Hall				H		
Spirifer (?) costalis Castelnau			Co?			
Spirifer cumberlandiæ Hall		×				
Spirifer cyclopterus Hall	×	×				
Spirifer davisi Nettelroth				H		
Spirifer disjunctus Sowerby						C
Spirifer disjunctus occidentalis Whiteaves						ND
Spirifer disjunctus sulcifer Hall and Clarke						C
Spirifer divaricatus Hall			Co	H		
Spirifer duodenarius Hall			Co			
Spirifer dupliplicatus (Conrad)				H		
Spirifer engelmanni Meek				MD		
Spirifer euruteines Owen				H		

TABLE VI.—*Devonian Brachiopoda*—Continued.

Species.	Eodevonian.		Mesodevonian.		Neodevonian.	
	Lower Helderberg.	Oriskany.	Schoharie, Corniferous.	Tully, Hamilton, Marcellus.	Portage, Huron, Genesee.	Chemung, Ithaca.
Spirifer filicostus A. Winchell				H		
Spirifer formosus Hall				H		
Spirifer fornaculus Hall				H		
Spirifer fornax Hall				H		
Spirifer gaspensis Billings		×				
Spirifer granulosus (Conrad)				H		
Spirifer gregarius Hall			Co			
Spirifer grieri Hall			Co			
Spirifer hemicyclus Meek and Worthen		×				
Spirifer hobbsi Nettelroth				H		
Spirifer hungerfordi Hall						C
Spirifer huronensis A. Winchell					P	
Spirifer intermedius Hall		×				
Spirifer inutilis Hall						ND
Spirifer iowensis Owen				MD		
Spirifer kennicotti Meek				MD		
Spirifer macbridii Calvin						ND
Spirifer macconathii Nettelroth				H		
Spirifer macrus Hall			Co			
Spirifer macropleurus (Conrad)	×					
Spirifer macrothyris Hall			Co			
Spirifer manni Hall			Co			
Spirifer marcyi Hall				H		
Spirifer mesastrialis Hall					P	I, C
Spirifer multicostatus Castelnau			Co?			
Spirifer murchisoni Castelnau		×				
Spirifer nictavensis Dawson		×				
Spirifer octocostatus Hall	×					
Spirifer orestes Hall and Whitfield						C
Spirifer paradoxus (Schlotheim)			Co			
Spirifer pennatus (Atwater)				M, H		I
Spirifer pennatus posterus Hall and Clarke						C
Spirifer pennatus tulliensis Williams				Tu		
Spirifer perextensus Meek and Worthen			Co			
Spirifer pertenuis Hall				H		
Spirifer pharovicinus A. Winchell					Hu	
Spirifer pinonensis Meek		ED		MD		ND
Spirifer pluto Clarke					G	
Spirifer rectiplicatus (Conrad)		×?				
Spirifer saffordi Hall	×					
Spirifer segmentus Hall			Co			
Spirifer strigosus Meek. Devonian.						
*Spirifer subattenuatus Hall						C
Spirifer subdecussatus Whiteaves				H		
Spirifer submucronatus Hall		×				
Spirifer substrigosus Webster						C
Spirifer subvaricosus Hall and Whitfield				H?		
Spirifer tenuis Hall				H		
Spirifer tenuistriatus Hall	×					
Spirifer tribulis Hall		×				
Spirifer tullius Hall				H		

TABLE VI.—*Devonian Brachiopoda*—Continued.

Species.	Eodevonian.		Mesodevonian.		Neodevonian.	
	Lower Helderberg.	Oriskany.	Schoharie, Corniferous.	Tully, Hamilton, Marcellus.	Portage, Huron, Genesee.	Chemung, Ithaca.
Spirifer urbanus Calvin				H		
Spirifer varicosus Hall			Co			
Spirifer whitneyi Hall						C
Spirifer williamsi Hall and Clarke						C
Spirifer worthenanus Schuchert		×				
Spirifer wortheni Hall				H		
Stringocephalus burtini Defrance				MD		
Strophalosia hystricula Hall						C
Strophalosia muricata Hall						C
Strophalosia radicans (A. Winchell)				H		
Strophalosia rockfordensis Hall						C
Strophalosia truncata (Hall)				M, H	P	I
Stropheodonta alveata Hall			Co			
Stropheodonta arcuata Hall						C
Stropheodonta beckii Hall	×					
Stropheodonta blainvillii (Billings)		ED				
Stropheodonta callawayensis Swallow				H		
Stropheodonta callosa Hall			Co			
Stropheodonta calvini Miller						C
Stropheodonta canace Hall and Whitfield						C
Stropheodonta cincta A. Winchell				H		
Stropheodonta concava Hall			Co	H		
Stropheodonta (?) costata Owen				H		
Stropheodonta crebristriata Hall			Co			
Stropheodonta demissa (Conrad)				MD		ND
Stropheodonta demissa imitata A. Winchell				H		
Stropheodonta erratica A. Winchell				H		
Stropheodonta fieldeni Etheridge		ED				
Stropheodonta galatea (Billings)		ED				
Stropheodonta hemispherica Hall			Co			
Stropheodonta inæquiradiata Hall			Co			
Stropheodonta inæquistriata (Conrad)			Co	M, H		
Stropheodonta indenta (Conrad)	×					
Stropheodonta interstrialis (Phillips)				MD		
Stropheodonta interstrialis (Vanuxem)						I
Stropheodonta iowensis Owen						ND?
Stropheodonta irene (Billings)			Co			
Stropheodonta junia Hall				H		
Stropheodonta kemperi Swallow				H		
Stropheodonta lincklæni Hall		×				
Stropheodonta macrostriata (Walcott)		ED				
Stropheodonta magnifica Hall		×				
Stropheodonta magniventra Hall		×				
Stropheodonta mucronata (Conrad)					P	I
Stropheodonta navalis Swallow				H		
Stropheodonta navalis boonensis Swallow				H		
Stropheodonta parva Owen				H		
Stropheodonta parva Hall			Co			
Stropheodonta patersoni Hall		×	Co			
Stropheodonta perplana (Conrad)		×	Co	H		I, C
Stropheodonta perplana nervosa Hall						I

TABLE VI.—*Devonian Brachiopoda*—Continued.

Species.	Eodevonian.		Mesodevonian.		Neodevonian.	
	Lower Helderberg.	Oriskany.	Schoharie, Corniferous.	Tully, Hamilton, Marcellus.	Portage, Huron, Genesee.	Chemung, Ithaca.
Stropheodonta perplana tulliensis Williams				Tu		
Stropheodonta planulata Hall	×					
Stropheodonta plicata Hall				H		
Stropheodonta tullia (Billings)			Co			
Stropheodonta variabilis Calvin						C
Stropheodonta varistriata (Conrad)	×					
Stropheodonta varistriata arata Hall	×					
Stropheodonta vascularia Hall		×				
Strophomena (?) elongata Conrad	×					
Strophomena (?) gibbosa Conrad			Co			
Strophonella ampla Hall			Co			
Strophonella cælata Hall						C
Strophonella cavumbona Hall	×					
Strophonella (?) conradi Hall	×					
Strophonella crassa Rowley				H		
Strophonella geniculata (Hall)	×					
Strophonella headleyana Hall	×					
Strophonella leavenworthana Hall	×					
Strophonella punctulifera (Conrad)	×					
Strophonella (?) radiata (Vanuxem)	×					
Strophonella reversa Hall						C
Strophonella schohariensis Castelnau			Co?			
Terebratula elia Hall				MD		
Terebratula jucunda Hall			Co			
Terebratula ontario Hall				H		
Terebratula traversensis A. Winchell				H		
Trematospira costata Hall	×					
Trematospira dubia (Billings)	×					
Trematospira equistriata Hall and Clarke	×					
Trematospira gibbosa Hall				H		
Trematospira hippolyte (Billings)	×					
Trematospira (?) liniuscula A. Winchell				H		
Trematospira maria (Billings)	×					
Trematospira multistriata Hall	×	×				
Trematospira perforata Hall	×					
Trematospira simplex Hall	×					
Trematospira tennesseensis Hall and Clarke	×					
Trigeria gaudryi Œhlert		×				
Trigeria (?) lepida Hall				H		
Trigeria (?) portlandica (Billings)	×					
Tropidoleptus carinatus (Conrad)				M, H		
Tropidoleptus occidens Hall				H		
Uncinulus abruptus (Hall)	×					
Uncinulus campbellanus (Hall)	×					
Uncinulus mutabilis Hall	×					
Uncinulus nobilis (Hall)	×					
Uncinulus nucleolata (Hall)	×					
Uncinulus pyramidatus (Hall)	×					
Uncinulus vellicata Hall	×					
Vitulina pustulosa Hall				H		
Whitfieldella (?) bisulcata (Vanuxem)	×					

TABLE VI.—*Devonian Brachiopoda*—Continued.

Species.	Eodevonian.		Mesodevonian.		Neodevonian.	
	Lower Helderberg.	Oriskany.	Schoharie, Corniferous.	Tully, Hamilton, Marcellus.	Portage, Huron, Genesee.	Chemung, Ithaca.
Whitfieldella (?) harpalyce (Billings)	×	.....	.....	.....	.....	.....
Zygospira (?) subconcava Meek and Worthen	×	.....	.....	.....	.....	.....
Number of Devonian species, 663.						
Number of species in each division	129	104	128	238	41	117
Number of species common to the Lower Helderberg and the other divisions	.....	8	2	2	1	2
Number of species common to the Oriskany and the other divisions	8	.....	15	7	0	3
Number of species common to the Corniferous and the other divisions	2	15	.....	27	2	7
Number of species common to the Hamilton and the other divisions	2	7	27	.....	12	22
Number of species common to the Genesee-Portage and the other divisions	1	1	4	12	.....	17
Number of species common to the Chemung and the other divisions	2	4	7	24	17	.....
Species common to the Devonian and Carboniferous systems, 11.						
Number of species passing from each division into the Carboniferous	1	1	1	4	3	10

TABLE VII.—*Carboniferous and Permian Brachiopoda.*

[B = Burlington; EC = Eocarboniferous; K = Keokuk; Ka = Kaskaskia; SL = St. Louis. Species preceded by an obelisk (†) are found in the Devonian also.]

Species.	Eocarboniferous.			Meso-carbon-iferous.	Neo-carbon-iferous.
	Kinder-hook.	Keo-kuk, Bur-lington.	Kaskas-kia, St. Louis.	Coal Meas-ures.	Per-mian.
Acambona osagensis (Swallow)	×				
Acambona prima White		B			
Ambocœlia minuta White	×				
Ambocœlia planoconvexa (Shumard)				×	×
Athyris bilioba (A. Winchell)	×				
Athyris (?) corpulenta (A. Winchell)	×				
Athyris densa Hall and Clarke			SL		
Athyris hannibalensis (Swallow)	×				
Athyris incressata Hall		B			
Athyris intervarica McChesney		B			
Athyris (?) jacksoni (Swallow)				×	
Athyris lamellosa (L'Eveille)	×	K			
Athyris missouriensis (A. Winchell)	×				
Athyris monticola (White)	EC				
Athyris ohioensis (A. Winchell)	×				
Athyris papillioniformis McChesney			Ka		
Athyris (?) perinflata McChesney		K			
Athyris prouti (Swallow)	×				
Athyris ultravarica McChesney		K			
Aulacorhynchus millipunctata (Meek and Worthen)				×	
Beecheria davidsoni Hall and Clarke				×	
Camarophorella lenticularis (White and Whitfield)		B			
Camarophoria (?) bisulcata Shumard				×	
Camarophoria caput-testudinis (White)		B			
Camarophoria explanata (McChesney)			Ka		
Camarophoria occidentalis Miller		B			
Camarophoria ringens (Swallow)		K			
Camarophoria subcuneata Hall			SL		
Camarophoria subtrigona Meek and Worthen		K			
Camarophoria thera Walcott		EC			
Camarophoria (?) wortheni (Hall)			SL		
†Camarotœchia contracta Hall	×				
Camarotœchia sagerana (A. Winchell)	×				
†Camarotœchia sappho Hall	×				
Centronella (?) allii A. Winchell	×				
Centronella (?) crassicardinalis Whitfield			SL		
Centronella (?) flora A. Winchell	×				
Chonetes geniculata White	×				
Chonetes glabra Geinitz				×	
Chonetes granulifera Owen				×	×
Chonetes illinoiensis Worthen		B			
Chonetes logani Norwood and Pratten	×	B			
†Chonetes logani aurora Hall		B			
Chonetes loganensis Hall and Whitfield	×				
Chonetes mesolobus Norwood and Pratten				×	
Chonetes michiganensis Stevens				×	
Chonetes multicosta A. Winchell	×	B			
Chonetes ornata Shumard	×				

TABLE VII.—*Carboniferous and Permian Brachiopoda*—Continued.

Species.	Eocarboniferous.			Meso-carbon-iferous.	Neo-carbon-iferous.
	Kinder-hook.	Keo-kuk, Bur-lington.	Kaskas-kia, St. Louis.	Coal Meas-ures.	Per-mian.
Chonetes parva Shumard				×	
Chonetes permiana Shumard				×	
Chonetes planumbona Meek and Worthen		K			
Chonetes platynotus White				×	
Chonetes pulchella A. Winchell	×				
†Chonetes setigera (Hall)	×				
Chonetes shumardiana de Koninck		K			
Chonetes tumida Herrick	×				
Chonetes variolata d'Orbigny				×	
Chonetes verneuiliana Norwood and Pratten				×	
Chonetes verneuiliana utahensis Meek				×	
Chonopectus fischeri (Norwood and Pratten)	×	B			
Cleiothyris clintonensis (Swallow)			Ka		
Cleiothyris crassicardinalis (White)	×				
Cleiothyris hirsuta (Hall)			SL, Ka		
Cleiothyris missouriensis (Swallow)				×	
Cleiothyris obmaxima (McChesney)		K			
Cleiothyris obvia (McChesney)			Ka		
Cleiothyris orbicularis (McChesney)				×	
Cleiothyris reflexa (Swallow)			SL		
Cleiothyris roissyi (L'Eveille)		K	SL, Ka		
Cleiothyris squamosa (Worthen)			SL		
Crania chesterensis Miller and Gurley			Ka		Ka
Crania lævis Keyes	×				
Crania modesta White and St. John				×	
Crania (?) permiana Shumard				×	
Crania reposita White		B			
Crania rowleyi Gurley	×				
Cryptacanthia compacta White and St. John				×	
†Cryptonella (?) eudora Hall	×				
Cryptonella (?) inconstans (Herrick)	×				
Cryptonella subelliptica Hall and Clarke	×				
Cryptonella alta Hall	×				
Cyrtina acutirostris (Shumard)	×				
Cyrtina burlingtonensis (Rowley)		B			
Cyrtina lachrymosa Hall and Clarke	×				
Cyrtina neogenes Hall and Clarke		B			
Cyrtina triplicata Simpson	×				
Derbya affinis Hall and Clarke				×	
Derbya bennetti Hall and Clarke				×	
Derbya biloba Hall				×	
Derbya broadheadi Hall and Clarke				×	
Derbya (?) costatula Hall and Clarke			Ka		
Derbya crassa (Meek and Hayden)				×	×
Derbya cymbula Hall and Clarke				×	
Derbya kaskaskiensis (McChesney)			Ka		
Derbya keokuk Hall	×	K			
Derbya pratteni (McChesney)				×	
Derbya robusta (Hall)				×	
Derbya ruginosa Hall and Clarke		K			

TABLE VII.—*Carboniferous and Permian Brachiopoda*—Continued.

Species.	Eocarboniferous.			Mesocarboniferous.	Neocarboniferous.
	Kinderhook.	Keokuk, Burlington.	Kaskaskia, St. Louis.	Coal Measures.	Permian.
Dielasma bovidens (Morton)				×	
Dielasma burlingtonensis White	×				
Dielasma formosa Hall			SL		
Dielasma gorbyi Miller		K			
Dielasma obovata Hall and Clarke				×?	
Dielasma occidentalis (Miller)	×				
Dielasma (?) rowleyi (Worthen)		B			
Dielasma sacculus (Martin)				×	
Dielasma shumardana Miller			Ka		
Dielasma turgida (Hall)			Ka		
Enteletes hemiplicata Hall				×	×
Eumetria (?) altirostris (White)	×				
Eumetria marcyi (Shumard)			SL, Ka		
Eumetria marcyi costata Hall			Ka		
Eumetria woosteri (White)				×?	
Glossina flabellula Hall and Clarke	×				
Glossina nebraskensis (Meek)				×	
Glossina sedaliensis (Miller)	×				
Glossina waverlyensis (Herrick)	×				
Harttina anna (Hartt)				×	
Hustedia (?) meekana (Shumard)				×	
Hustedia mormoni (Marcou)				×	
Hustedia (?) papillata (Shumard)				×	
Hustedia (?) triangularis (Miller)	×				
Leiorhynchus boonense (Shumard)		B			
Leiorhynchus newberryi Hall	×				
†Leptæna rhomboidalis (Wilckens)	×				
Lingula atra Herrick	×				
Lingula carbonaria Shumard				×	
Lingula crawfordsvillensis Gurley		K			
†Lingula cuyahoga Hall	×				
Lingula gannensis Herrick	×				
Lingula gorbyi Miller	×				
Lingula halli White		B			
Lingula indianensis Miller and Gurley		K			
Lingula meeki Herrick	×				
Lingula melie Hall	×				
Lingula membranacea A. Winchell	×				
Lingula mytiloides Sowerby				×	
Lingula paracletus Hall and Clarke	×				
Lingula parrishi Miller				×	
Lingula tighti Herrick				×	
Lingula umbonata Cox				×	
Lingula varsoviense Worthen			SL		
Lingulodiscina (?) connata Walcott		EC			
Lingulodiscina newberryi Hall	×				
Lingulodiscina pleurites (Meek)	×				
Martinia glabra (Martin)				×	
Martinia glabra contracta Meek and Worthen			Ka		
Martinia lævigata (Swallow)		K			

TABLE VII.—*Carboniferous and Permian Brachiopoda*—Continued.

Species.	Eocarboniferous.			Mesocarboniferous.	Neocarboniferous.
	Kinderhook.	Keokuk, Burlington.	Kaskaskia, St. Louis.	Coal Measures.	Permian.
Meekella occidentalis (Newberry)				×	
Meekella (?) occidentalis (Swallow)				×	
Meekella pyramidalis (Newberry)				×	
Meekella striatocostata (Cox)				×	×
Meristella (?) incerta Simpson	×				
Nucleospira barrisi White	×				
Orbiculoidea (?) capax (White)	×				
Orbiculoidea capuliformis (McChesney)				×	
Orbiculoidea convexa (Shumard)				×	
Orbiculoidea gallaheri (A. Winchell)	×				
Orbiculoidea hertzeri Hall and Clarke	×				
Orbiculoidea keokuk (Gurley)		K			
Orbiculoidea illinoiensis (Miller and Gurley)				×	
Orbiculoidea magnifica Herrick	×				
Orbiculoidea manhattenensis (Meek and Hayden)				×	
Orbiculoidea missouriensis (Shumard)				×	
Orbiculoidea (?) munda (Miller and Gurley)				×	
Orbiculoidea nitida (Phillips)				×	
Orbiculoidea patellaris (A. Winchell)	×				
Orbiculoidea saffordi (A. Winchell)	EC				
Orbiculoidea sampsoni (Miller)	×				
Orbiculoidea subtrigonalis (McChesney)				×	
Orbiculoidea tenuilineata (Meek and Hayden)				×	
Orbiculoidea utahensis (Meek)				×	
Orbiculoidea varsoviensis (Worthen)		K			
Orthis (?) flava A. Winchell	×				
Orthothetes crenistrius (Phillips)		EC			
Orthothetes desideratus Hall and Clarke	×				
Orthothetes inæqualis (Hall)	×				
Orthothetes inflatus (White and Whitfield)	×				
Orthothetes lens (White)	×				
Orthothetes umbraculum Authors		EC		×	
Proboscidella (?) clava (Norwood and Pratten)				×	
Productella arcuata Hall	×				
Productella concentrica (Hall)	×				
†Productella lachrymosa stigmata Hall	×				
Productella pyxidata Hall	×				
Productella shumardana Hall	×				
†Productella speciosa Hall	×				
Productus alternatus Norwood and Pratten		K			
Productus altonensis Norwood and Pratten			SL		
Productus auriculatus Swallow				×	
Productus bisinuatus Hall			SL		
Productus blairi Miller	×				
Productus boliviensis d'Orbigny				×	
Productus boonensis Swallow				×	
Productus boonensis elevata Swallow				×	
Productus buchianus de Koninck				×	
Productus burlingtonensis Hall		B			
Productus carbonarius de Koninck. Carboniferous.					

TABLE VII.—*Carboniferous and Permian Brachiopoda*—Continued.

Species.	Eocarboniferous.			Meso-carbon-iferous.	Neo-carbon-iferous.
	Kinder-hook.	Keo-kuk, Bur-lington.	Kaskas-kia, St. Louis.	Coal Meas-ures.	Per-mian.
Productus confragosus Conrad				×	
Productus cooperensis Swallow	×				
Productus cora d'Orbigny				×	
Productus cora mogoyoni Marcou				×	
Productus coræformis Swallow			SL		
Productus costatoides Swallow				×	
Productus costatus de Koninck				×	×
Productus curtirostratus A. Winchell	×				
Productus delawari Marcou		EC			
Productus depressus Swallow		K			
Productus dolorosus A. Winchell	×				
Productus duplicostatus A. Winchell	×				
Productus fasciculatus McChesney			Ka		
Productus fentonensis Swallow		K			
Productus fimbriatus Sowerby			SL?	×?	
Productus flexistrius McCoy			Ka		
Productus giganteus (Martin)			EC		
Productus gracilis A. Winchell	×				
Productus gradatus Swallow		K			
Productus granulosus Phillips		K			
Productus hepar Morton				×	
Productus hildrethanus Norwood and Pratten				×	
Productus indianensis Hall			SL		
Productus inflatus McChesney				×	
Productus ivesi Newberry				×	
Productus lævicostus White	×				
Productus lasallensis Worthen				×	
Productus latissimus Sowerby				×?	
Productus leuchtenbergensis de Koninck				×?	
Productus longispinus Sowerby?				×	
Productus longus Meek. Carboniferous.					
Productus magnicostatus Swallow				×	
Productus magnus Meek and Worthen		K			
Productus margaritaceus Phillips				×	
Productus marginicinctus Prout			SL		
Productus mesialis Hall		K			
Productus mesolobus Phillips. Carboniferous.					
Productus mexicanus Shumard				×	
Productus morbillianus A. Winchell		B			
Productus multistriatus Meek. Carboniferous.					
Productus muricatus Norwood and Pratten				×	
Productus nanus Meek and Worthen				×	
Productus nebrascensis Owen				×	×
Productus nevadensis Meek				×	
Productus newberryi Hall	×				
Productus newberryi annosus Herrick	×				
Productus nodocostatus Herrick	×				
Productus nodosus Newberry				×	
Productus norwoodi Swallow				×	
Productus occidentalis Newberry				×	

TABLE VII.—*Carboniferous and Permian Brachiopoda*—Continued.

Species.	Eocarboniferous.			Mesocarboniferous.	Neocarboniferous.
	Kinderhook.	Keokuk, Burlington.	Kaskaskia, St. Louis.	Coal Measures.	Permian.
Productus ovatus Hall			SL		
Productus parvulus A. Winchell	×				
Productus parvus Meek and Worthen			Ka		
Productus pertenuis Meek				×	
Productus phillipsi Norwood and Pratten. Carboniferous.					
Productus pileolus Shumard				×	
Productus pocillum Morton				×	
Productus popii Shumard				×	
Productus punctatus (Martin)				×	
Productus pustulosus Phillips				×	
Productus raricostatus Herrick	×				
Productus rushvillensis Herrick	×				
Productus scabriculus (Martin)			EC	×	
Productus scitulus Meek and Worthen			SL		
Productus semireticulatus (Martin)		K	SL	×	×
Productus semireticulatus kansasensis Swallow				×	
Productus semistriatus Meek				×	
Productus subhorridus Meek. Carboniferous.					
Productus swallovi Beecher			Ka		
Productus symmetricus McChesney				×	
Productus tenuicostatus Hall			SL		
Productus undiferus de Koninck				×	
Productus viminalis White		B			
Productus wortheni Hall		K			
Productus weyprechti Toula				×	
Ptychospira sexplicata White and Whitfield	×				
Pugnax dawsonianus (Davidson)				×	
Pugnax globulina (Davidson)				×	
Pugnax grosvenori Hall			SL		
Pugnax mutatus Hall		K	SL		
Pugnax ottumwa (White)			SL		
Pugnax pugnus missouriensis (Shumard)	×				
Pugnax rockymontanus (Marcou)				×	
Pugnax striatocostatus (Meek and Worthen)	×				
Pugnax swallovanus (Shumard)				×	
Pugnax utah (Marcou)				×	
Reticularia cooperensis (Swallow)	×				
Reticularia guadalupensis (Shumard)				×	
Reticularia perplexa (McChesney)				×	
Reticularia perplexa striatolineata (Swallow)				×	
Reticularia pseudolineata (Hall)		B, K			
Reticularia setigera (Hall)			Ka		
Reticularia (?) temeraria (Miller)		B			
Reticularia tenuispinata (Herrick)	×				
Reticularia translata (Swallow)			Ka		
Retzia (?) circularis Miller	×				
Retzia (?) plicata Miller	×				
Retzia (?) popeana Swallow	×				
Rhipidomella burlingtonensis Hall		B			
Rhipidomella clarkensis (Swallow)		K			

TABLE VII.—*Carboniferous and Permian Brachiopoda*—Continued.

Species.	Eocarboniferous.			Mesocarboniferous.	Neocarboniferous.
	Kinderhook.	Keokuk, Burlington.	Kaskaskia, St. Louis.	Coal Measures.	Permian.
Rhipidomella dalyana (Miller)		B			
Rhipidomella dubia Hall			SL		
Rhipidomella michelini (L'Eveille)	×				
Rhipidomella missouriensis (Swallow)	×				
Rhipidomella nevadensis (Meek). Carboniferous.					
Rhipidomella occasus Hall	×				
Rhipidomella oweni Hall and Clarke	×				
Rhipidomella pecosi (Marcou)				×	
Rhipidomella subelliptica (White and Whitfield)	×				
Rhipidomella thiemii (White)	×				
Rhipidomella vanuxemi pulchella Herrick	×				
Rhynchonella acadiensis Davidson				×	
Rhynchonella algeri McChesney				×	
Rhynchonella arctirostrata Swallow			SL		
Rhynchonella barquensis A. Winchell	×				
Rhynchonella camarifera A. Winchell	×				
Rhynchonella carbonaria McChesney				×	
Rhynchonella cooperensis Shumard	×				
Rhynchonella eurekensis Walcott			EC		
Rhynchonella evangelina Hartt				×	
Rhynchonella guadalupe Shumard				×	
Rhynchonella heteropsis A. Winchell	×				
Rhynchonella hubbardi A. Winchell	×				
Rhynchonella ida Hartt				×	
Rhynchonella illinoisensis Worthen				×	
Rhynchonella indentata Shumard				×	
Rhynchonella macra Hall			SL		
Rhynchonella medialis Simpson	×				
Rhynchonella metallica White				×	
Rhynchonella micropleura A. Winchell	×				
Rhynchonella obsolescens Hall	×				
Rhynchonella opposita White and Whitfield	×				
Rhynchonella perrostellata Swallow			SL		
Rhynchonella persinuata A. Winchell	×				
Rhynchonella pleurodon (Phillips)				×	
Rhynchonella ricinula Hall			SL		
Rhynchonella striata Simpson	×				
Rhynchonella subcircularis A. Winchell	×				
Rhynchonella tetraptyx A. Winchell	×				
Rhynchonella texana Shumard				×	
Rhynchonella tuta Miller		B			
Rhynchonella unica A. Winchell	×				
Rhynchonella whitii A. Winchell	×				
Rhynchopora pustulosa (White)	×				
Rhynchospira (?) ashlandensis Herrick	×				
Rhynchospira scansa Hall and Clarke	×				
Romingerina julia (A. Winchell)	×				
Schizophoria resupinata (Martin)		EC			
Schizophoria resupinoides (Cox)				×	
Schizophoria swallovi Hall		B			

TABLE VII.—*Carboniferous and Permian Brachiopoda*—Continued.

Species.	Eocarboniferous.			Mesocarboniferous.	Neocarboniferous.
	Kinderhook.	Keokuk, Burlington.	Kaskaskia, St. Louis.	Coal Measures.	Permian.
Seminula argentea (Shepard)				×	×
Seminula caput-serpentis (Swallow)				×	
Seminula charitonensis (Swallow)				×	
Seminula claytoni (Hall and Whitfield)	×				
Seminula dawsoni Hall and Clarke				×	
Seminula formosa (Swallow)		K			
Seminula hawni (Swallow)				×	
Seminula maconensis (Swallow)				×	
Seminula parva (Swallow)		K			
Seminula persinuata (Meek). Carboniferous.					
Seminula (?) plattensis (Swallow)				×	
Seminula singletonii (Swallow)				×	
Seminula subquadrata (Hall)			Ka		
Seminula trinuclea Hall			SL		
Seminula wasatchensis (White)				×	
Spirifer acuticostatus de Koninck				×	
Spirifer agelaius Meek		EC			
Spirifer albapinensis Hall and Whitfield	×				
Spirifer annectans Walcott		EC			
Spirifer biplicatus Hall	×				
Spirifer boonensis Swallow				×	
Spirifer cameratus Morton				×	
Spirifer cameratus percrassus Swallow				×	
Spirifer centronatus A. Winchell	×				
Spirifer clavatulus McChesney		B			
Spirifer deltoideus Herrick	×				
Spirifer desideratus Walcott		EC			
Spirifer duplicostus Phillips. Carboniferous.					
Spirifer fastigatus Morton. Carboniferous.					
Spirifer (?) fimbriatus Morton				×	
Spirifer forbesi Norwood and Pratten		B			
Spirifer fultonensis Worthen				×	
Spirifer grimesi Hall	×	B			
Spirifer imbrex Hall		B			
Spirifer incertus Hall		B			
Spirifer increbescens Hall			Ka		
Spirifer increbescens americanus Swallow			Ka		
Spirifer increbescens transversalis Hall			Ka		
Spirifer kelloggi Swallow		K			
Spirifer keokuk Hall		K			
Spirifer keokuk shelbyensis Swallow			SL		
Spirifer lateralis Hall			SL		
Spirifer latior Swallow	×				
Spirifer leidyi Norwood and Pratten			SL		
Spirifer leidyi chesterensis Swallow			Ka		
Spirifer leidyi merimacensis Swallow			SL		
Spirifer littoni Swallow			SL		
Spirifer logani Hall		K			
Spirifer marconi Waagen				×	
Spirifer marionensis Shumard	×				

TABLE VII.—*Carboniferous and Permian Brachiopoda*—Continued.

Species.	Eocarboniferous.			Meso-carbon-iferous.	Neo-carbon-iferous.
	Kinder-hook.	Keo-kuk, Bur-lington.	Kaskas-kia, St. Louis.	Coal Meas-ures.	Per-mian.
Spirifer meeki Swallow		B			
Spirifer mexicanus Shumard				×	
Spirifer missouriensis Swallow	×				
Spirifer mortonanus Miller		K			
Spirifer mundulus Rowley		B			
Spirifer mysticensis Meek		EC			
Spirifer neglectus Hall		K			
Spirifer newberryi Hall	×				
Spirifer novamexicanus Miller		B			
Spirifer oregonensis Shumard				×	
Spirifer osagensis Swallow	×				
Spirifer ovalis Phillips. Carboniferous.					
Spirifer peculiaris Shumard	×				
Spirifer rockymontanus Marcou				×	
Spirifer rostellatus Hall		K			
Spirifer rostratus Morton				×	
Spirifer scobina Meek. Carboniferous.					
Spirifer sillanus A. Winchell	×				
Spirifer striatiformis Meek	×				
Spirifer striatus (Martin)	×	B			
Spirifer subæqualis Hall			SL		
Spirifer subattenuatus Hall	×				
Spirifer subcardiformis Hall			SL		
Spirifer suborbicularis Hall		K			
Spirifer subrotundatus Hall	×				
Spirifer sulciferus Shumard				×	
Spirifer taneyensis Swallow	×				
Spirifer tenuicostatus Hall		K	SL		
Spirifer tenuimarginatus Hall		K			
Spirifer texanus Meek				×	
Spirifer trigonalis Martin			EC		
Spirifer vernonensis Swallow	×				
Spirifer vernonensis ozarkensis Swallow	×				
Spirifer waverlyensis A. Winchell	×				
Spirifer winchelli Herrick	×				
Spiriferina aciculifera Rowley	×				
Spiriferina billingsi Shumard				×	
Spiriferina binacuta A. Winchell		B			
Spiriferina clarksvillensis A. Winchell	×				
Spiriferina cristata (Schlotheim)				×	
Spiriferina depressa Herrick	×				
Spiriferina gonionota Meek				×	
Spiriferina norwoodana (Hall)			SL		
Spiriferina octoplicata (Sowerby)				×	
Spiriferina pulchra Meek				×	
Spiriferina solidirostris White	×				
Spiriferina spinosa (Norwood and Pratten)			Ka		
Spiriferina subelliptica (McChesney)		K			
Spiriferina subtexta White		B			
Spiriferina transversa (McChesney)			Ka		

TABLE VII.—*Carboniferous and Permian Brachiopoda*—Continued.

Species.	Eocarboniferous.			Meso-carbon-iferous.	Neo-carbon-iferous.
	Kinder-hook.	Keo-kuk, Bur-lington.	Kaskas-kia, St. Louis.	Coal Meas-ures.	Per-mian.
Streptorhynchus (?) multistriata Meek and Hayden	.....	.....	.....	×	.....
Streptorhynchus ulrichi Hall and Clarke	.....	.....	Ka	.....	.....
Stricklandinia (?) subquadrata Herrick	.....	.....	.....	×	.....
Strophalosia beecheri Rowley	×	.....	.....	.....	.....
Strophalosia cymbula Hall and Clarke	.....	K	.....	.....	.....
Strophalosia (?) guadalupensis (Shumard)	.....	.....	.....	×	.....
Strophalosia keokuk Beecher	.....	K	.....	.....	.....
Strophalosia nummulina A. Winchell	×	.....	.....	.....	.....
Strophalosia scintilla Beecher	×	.....	.....	.....	.....
Strophalosia spondyliformis (White and St. John)	.....	.....	.....	×	.....
Strophomena (?) nassula Conrad. Carboniferous.					
Syringothyris angulata Simpson	×	.....	.....	.....	.....
Syringothyris carteri (Hall)	×	B	.....	.....	.....
Syringothyris extenuata (Hall)	×	.....	.....	.....	.....
Syringothyris gigas (Troost). Lower Carboniferous.					
Syringothyris herricki Schuchert	×	.....	.....	.....	.....
Syringothyris missouri Hall and Clarke	×	.....	.....	.....	.....
Syringothyris (?) plena (Hall)	.....	B	.....	.....	.....
Syringothyris randalli Simpson	×	.....	.....	.....	.....
Syringothyris texta (Hall)	×	K	.....	.....	.....
Terebratula biasacula McChesney	.....	.....	Ka	.....	.....
Terebratula brevilobata Swallow	.....	.....	SL	.....	.....
Terebratula inornata McChesney	.....	K	SL	×	.....
Terebratula lapillus Morton	.....	.....	.....	×	.....
Terebratula mexicana Hall	.....	.....	.....	×?	.....
Terebratula perinflata Shumard	.....	.....	.....	×	.....
Terebratula subretziaforma McChesney	.....	.....	Ka	.....	.....
Terebratula swallovana Miller	.....	.....	Ka	.....	.....
Terebratula utah Hall and Whitfield	×	.....	.....	.....	.....
Torynifer criticus Hall and Clarke	.....	.....	SL	.....	.....
Number of Carboniferous species, 478.					
Number of species in each division	156	93	74	158	9
Number of species common to the Kinderhook and the other divisions	.....	9	0	0	0
Number of species common to the Burlington-Keokuk and the other divisions	9	.....	5	4	1
Number of species common to the St. Louis-Kaskaskia and the other divisions	0	5	.....	5	1
Number of species common to the Coal Measures and the other divisions	0	4	5	.....	9
Number of species common to the Permian and the other divisions	0	1	1	9	.....
No species pass from the Carboniferous into the Mesozoic.					

TABLE VIII.—*Mesozoic Brachiopoda.*

Species.	Triassic.	Jurassic.	Lower Cretaceous.	Upper Cretaceous.
Cistella beecheri Clark				×
Cistella plicatilis Clark				×
Discina (?) pileolus Whiteaves			×	
Discina (?) semipolita Whiteaves				× ?
Discina (?) vancouverensis Whiteaves				× ?
Kingena leonensis (Conrad)			×	
Kingena wacoensis (Roemer)			×	
Lingula brevirostris Meek and Hayden		×		
Lingula nitida Meek and Hayden				×
Lingula shumardi Cragin			×	
Lingula subspatulata Hall and Meek				×
Rhynchonella æquiplicata Gabb	×			
Rhynchonella gnathophora Meek		×		
Rhynchonella halli Gabb	×			
Rhynchonella lacunosa (Schlotheim)		×		
Rhynchonella lacunosa arolica Oppel		×		
Rhynchonella lingulata Gabb	×			
Rhynchonella mandensis Whiteaves				× ?
Rhynchonella myrina Hall and Whitfield		×		
Rhynchonella plicatilis (Sowerby)				× ?
Rhynchonella schucherti Stanton				×
Rhynchonella tayloriana Lea. Habana, Cuba		× ?		
Rhynchonella whitneyi Gabb				×
Spiriferina (?) alia Hall and Whitfield	×			
Spiriferina borealis Whiteaves	×			
Spiriferina homfrayi (Gabb)	×			
Spiriferina obtusa (Gabb)	×			
Terebratella californica Stanton				×
Terebratella (?) dubitanda (Cooper)				× ?
Terebratella (?) imbricata (Cooper)				× ?
Terebratella obesa Gabb				×
Terebratella plicata (Say)				×
Terebratella vanuxemi Lyell and Forbes				×
Terebratula augusta Hall and Whitfield	×	×		
Terebratula dorenbergi Felix. Mexico		×		
Terebratula harlani Morton				×
Terebratula helena Whitfield				×
Terebratula humboltensis Gabb	×			
Terebratula liardensis Whiteaves	×			
Terebratula poeyana Lea. Habana, Cuba		× ?		
Terebratula repellini d'Orbigny. Mexico		×		
Terebratula robusta Whiteaves		× ?		
Terebratula semisimplex White	×			
Terebratula cfr. zieteni Loriol. Mexico		×		
Terebratulina atlantica (Morton)				×
Terebratulina filosa Conrad				× ?
Terebratulina floridana (Morton)				×
Terebratulina guadalupæ (Roemer)				×
Waldheimia (?) catorcensis Aguilera. Mexico		×		
Number of Mesozoic species, 49. Number of species in each system	11	13	4	22

TABLE IX.—*Cenozoic and Recent Brachiopoda.*

Species.	CENOZOIC.		RECENT.	
	Eocene.	Neocene.	North and Central American Atlantic.	North and Central American Pacific.
Discinisca lugubris (Conrad)		×		
Discinisca multilineata (Conrad)		×		
Hemithyris psittacea (Chemnitz)		×		
Rhynchonella wilmingtonensis (Lyell and Sowerby)	×			
Terebratula canipes Ravenel	×			
Terebratula carneoidea Guppy. Trinidad	×			
Terebratula demissirostra Conrad	×			
Terebratula lecta Guppy. Trinidad	×			
Terebratula nitens (Conrad)		×		
Terebratula trinitatensis Guppy. Trinidad	×			
Terebratulina gracilis (Schlotheim)	×			
Terebratulina lachryma (Morton)	×			
Terebratulina tejonensis Stanton	×			
Waldheimia kennedyi Dall		×		
Number of species in each division	9	5		
Atretia gnomon Jeffrys			×	
Cistella cistellula (Wood)			×	
Dallina floridana (Pourtales)			×	
Discinisca atlantica (King)			×	
Discinisca cumingi (Broderip)				×
Frielcia halli Dall				×
Glottidia albida (Hinds)			×	×
Glottidia antillarum (Reeve)				×
Glottidia audebarti (Broderip)				×
Glottidia palmeri Dall				×
Hemithyris craneana Dall				×
Hemithyris psittacea (Chemnitz)		×	×	×
Kraussina pisum (Lamarck)				×
Lacqueus californicus (Koch)				×
Lacqueus jeffreysi Dall				×
Lacqueus vancouverensis Davidson				×
Liothyrina bartletti (Dall)			×	
Liothyrina clarkeana Dall			×	
Macandrevia americanum Dall				×
Macandrevia craniella Dall				×
Macandrevia cranium (Müller)			×	
Macandrevia diamantina Dall			×	×
Magasella aleutica Dall				×
Magasella labradorensis (Sowerby)			×	
Magasella radiata Dall			×	×
Platidia anomioides (Phillippi)				×
Terebratalia obsoleta Dall				×
Terebratalia occidentalis Dall				×
Terebratalia transversa (Sowerby)				×
Terebratella frielii Davidson			×	
Terebratella pulvinata (Gould)				×
Terebratella spitzbergensis Davidson			×	
Terebratulina caput-serpentis (Linné)				×
Terebratulina kiensis Dall and Pillsbry				×
Terebratulina murrayi Davidson			×	
Terebratulina septentrionalis Couthouy			×	
Number of species in each ocean			15	24

TABLE X.—*South American fossil Brachiopoda.*

[J = Jurassic. Species preceded by an asterisk (*) are found in North America also.]

Species.	Cambrian.	Ordovician.	Silurian.	Devonian.	Carboniferous.	Jurassic, Triassic.	Cretaceous.	Tertiary.
*Ambocœlia planoconvexa (Shumard)					×			
*Amphigenia elongata (Vanuxem)				×				
Anabia parais Clarke			×					
*Anoplotheca flabellites (Conrad)				×				
*Camarotœchia dotis Hall				×				
Centronella (?) arcii A. Ulrich				×				
Centronella (?) silvetii A. Ulrich				×				
Chonetes amazonica Derby					×			
Chonetes (?) arcii A. Ulrich				×				
Chonetes comstockii Rathbun				×				
Chonetes curuaensis Rathbun				×				
Chonetes falklandica (Morris and Sharpe)				×				
Chonetes freitassii Rathbun				×				
*Chonetes glabra Geinitz					×			
*Chonetes granulifera Owen					×			
Chonetes herbert-smithi Rathbun				×				
Chonetes onettiana Rathbun				×				
Chonetes rucki A. Ulrich				×				
Chonetes stübeli A. Ulrich				×				
*Chonetes variolata d'Orbigny					×			
*Chonostrophia complanata Hall?				×				
*Cleiothyris roissyi (L'Eville)					×			
Clitambonites adscendens (Pander?)		×						
Cyrtina (?) curupira Rathbun				×				
Dalmanella (?) nettoana (Rathbun)				×				
Derbya correanus (Derby)					×			
Dielasma hochstetteri (Toula)					×			
Dielasma itaitubensis (Derby)					×			
Enteletes andii (d'Orbigny)					×			
Enteletes gaudryi (d'Orbigny)					×			
Glossina dubia (d'Orbigny)		×						
*Glossina trentonensis (Conrad?)		×						
Harttina coutinhoana (Derby)					×			
*Hustedia mormoni (Marcou)					×			
Leptæna (?) stelzneri Kayser		×						
Lingula coheni A. Ulrich				×				
Lingula ererensis Rathbun				×				
Lingula gracana Rathbun				×				
Lingula metensis Terquem						J		
Lingula munsteri d'Orbigny		×						
Lingula plagemanni Möricke						J		
Lingula rodriguezii Rathbun				×				
*Lingula spatulata Vanuxem				×				
Lingula stantoniana Rathbun				×				
Lingula submarginata d'Orbigny		×						
Lingula truncata Sowerby							×	
Meristella riskowyi A. Ulrich				×				
Notothyris (?) smithii Derby				×				
Orbiculoidea baini Morris and Sharpe				×				
*Orbiculoidea lodensis (Vanuxem)				×				

TABLE X.—*South American fossil Brachiopoda*—Continued.

Species.	Cambrian.	Ordovician.	Silurian.	Devonian.	Carboniferous.	Jurassic. Triassic.	Cretaceous.	Tertiary.
Orthis buchi d'Orbigny					×			
Orthis calligramma (Davidson) Kayser		×						
Orthis concinna Morris and Sharpe				×				
Orthis disparilis Kayser		×						
Orthis humboldti d'Orbigny			×					
Orthis (?) laticostata d'Orbigny				×				
Orthis lenticularis Wahlenberg ?	×							
Orthis obtusa Pander		×						
Orthis (?) pectinata d'Orbigny				×				
Orthis saltensis Kayser	×							
Orthis (?) sulivanti Morris and Sharpe				×				
Orthis (?) tenuis Morris and Sharpe				×				
Orthis vespertilio Sowerby		×						
Orthothetes agassizi (Rathbun)				×				
Orthothetes tapajotensis (Derby)					×			
Orthotichia morganiana (Derby)					×			
* Plectambonites sericea (Sowerby)		×						
Productella mæcuruensis Rathbun				×				
Productus batesianus Derby					×			
* Productus boliviensis d'Orbigny					×			
Productus capacii d'Orbigny					×			
Productus chandlessii Derby					×			
Productus clarkianus Derby					×			
* Productus cora d'Orbigny					×			
* Productus costatus (Sowerby) de Koninck					×			
Productus humboldti d'Orbigny					×			
* Productus longispinus Sowerby ?					×			
Productus papilio Gabb					×			
Productus peruvianus d'Orbigny					×			
Productus reticulatus Gabb					×			
Productus rhomianus Derby					×			
* Productus semireticulatus (Martin)					×			
Productus villiersi d'Orbigny					×			
Productus wallacianus Derby					×			
* Reticularia perplexa (McChesney)					×			
Retzia (?) jamesiana Rathbun				×				
Rhipidomella hartti (Rathbun)				×				
Rhipidomella inca (d'Orbigny)				×				
Rhipidomella penniana Derby					×			
Rhynchonella ænigma (d'Orbigny)						J		
Rhynchonella anduin Gottsche						J		
Rhynchonella antisiensis (d'Orbigny)				×				
Rhynchonella antonii Gabb							× ?	
Rhynchonella belemnitica Quenstedt						J		
Rhynchonella caracolensis Gottsche						J		
Rhynchonella ererensis Rathbun				×				
Rhynchonella manfiasensis Möricke						J		
Rhynchonella pipira Derby					×			
* Rhynchonella pleurodon (Phillips)					×			
Rhynchonella plicatissima Quenstedt						J		
Rhynchonella subtetræda (Conrad)							× ?	

TABLE X.—*South American fossil Brachiopoda*—Continued.

Species.	Cambrian.	Ordovician.	Silurian.	Devonian.	Carboniferous.	Jurassic, Triassic.	Cretaceous.	Tertiary.
Rhynchonella tetrœda (Sowerby)						J		
Rhynchonella triplicata Quenstedt						J		
Scaphiocœlia boliviensis Whitfield				×				
Schizophoria cora (d'Orbigny)					×			
*Seminula argentea (Shepard)					×			
Seminula titicacensis (Gabb)					×			
Spirifer antarcticus Morris and Sharpe				×				
Spirifer buarquianus Rathbun				×				
Spirifer boliviensis d'Orbigny				×				
Spirifer chuquiscus Ulrich				×				
Spirifer condor d'Orbigny					×			
*Spirifer duodenarius Hall				×				
Spirifer elizæ Rathbun				×				
Spirifer hartti Rathbun				×				
Spirifer hawkinsi Morris and Sharpe				×				
Spirifer mæcuruensis Rathbun				×				
*Spirifer murchisoni Castelnau				×				
Spirifer orbignii Morris and Sharpe				×				
Spirifer pedroanus Rathbun				×				
Spirifer pentlandi d'Orbigny					×			
Spirifer quichuus d'Orbigny				×				
*Spirifer rockymontanus Marcou					×			
Spirifer valenteanus Rathbun				×				
Spirifer vogeli von Ammon				×				
*Spiriferina cristata (Schlotheim)					×			
Spiriferina cfr. münsteri Davidson						J		
Spiriferina rostrata Schlotheim						J		
*Spiriferina spinosa (Norwood and Pratten)					×			
Spirigerella derbyi Waagen					×			
Streptorhynchus hallianus Derby					×			
Strophalosia cornelliana Derby					×			
*Strophecdonta perplana (Conrad)				×				
Strophomena (?) talacastrensis Kayser		×						
Terebratula bicanaliculata Schlotheim						J		
Terebratula chilensis d'Orbigny								×
Terebratula copiapensis Möricke						J		
Terebratula derbyana Rathbun				×				
Terebratula domeykana Bayle and Coquand						J		
Terebratula emarginata Sowerby						J		
Terebratula ficoides Bayle and Coquand						J		
Terebratula gottschii Steinman						J		
Terebratula hohmanni Möricke						J		
Terebratula ignaciana d'Orbigny						J		
Terebratula lacunosa Schlotheim						J		
Terebratula meridionalis Conrad							×	
Terebratula patagonica Sowerby								×
Terebratula perforata Piette						J		
Terebratula perovalis Sowerby						J		
Terebratula punctata Sowerby						J		
Terebratula raimondiana Gabb							×?	
Terebratula subexcavata Conrad							×	

TABLE X.—*South American fossil Brachiopoda*—Continued.

Species.	Cambrian.	Ordovician.	Silurian.	Devonian.	Carboniferous.	Jurassic, Triassic.	Cretaceous.	Tertiary.
Terebratula subovoides Roemer	.....	.....	.....	.....	.....	J	.....	.....
Terebratula subnumismalis Davidson	.....	.....	.....	.....	.....	J	.....	.....
Trigeria (?) margarida (Derby)	.....	.....	.....	×	.....	.....	.....	.....
Trigeria (?) wardiana (Rathbun)	.....	.....	.....	×	.....	.....	.....	.....
Tropidoleptus carinatus (Conrad)	.....	.....	.....	×	.....	.....	.....	.....
Vitulina pustulosa Hall	.....	.....	.....	×	.....	.....	.....	.....
Number of South American species, 159.								
Number of species in each system	2	12	2	61	47	26	6	2
Number of species common to South and North America, 28.								

CHAPTER II.

BRACHIOPOD TERMINOLOGY APPLIED TO FOSSIL FORMS.

Adductor muscles.—In the Protremata and Telotremata these muscles have their ventral insertion one on either side of the central axis, between the diductors. In passing to the dorsal valve they divide into four, and produce in that shell the two pairs of principal scars known as the anterior and posterior adductors. By contraction these muscles close the shell. In the Neotremata they are the essential muscles, so far as scars in the fossil shells are concerned, the anterior adductors closing the valves, while the posterior pair serves to open the valves. In the Atremata there is a simple pair of adductors placed near the anterior extremity of the visceral area.

Anterior region.—That portion of the shell in front of the transverse axis and opposite the pedicle opening.

Apex.—The place of initial shell growth. It may be the most posterior portion of the valve or may be situated near the transverse axis.

Brachidium (Hall and Clarke).—The calcareous brachial supports of the Spiriferacea and Terebratulacea.

Cardinal area.—A more or less well-developed triangular area on each side of the delthyrium, distinctly set off from the general surface of the shell. It is best developed on the ventral valve of articulate brachiopods, but is also present on the dorsal valve, and generally in a rudimentary condition in many inarticulate species. See *Deltidium.*

Cardinal extremities.—The terminations of the hinge line.

Cardinal process.—A variously modified apophysis, situated posteriorly at the center of the hinge of the dorsal valve in articulate brachiopods. To it are attached the diductor muscles, which by their contraction serve to open the valves anteriorly.

Cardinal slopes.—The inclined surfaces extending from the umbonal slopes to the hinge margins.

Chilidium (Beecher).—A plate, in appearance similar to the deltidium, covering the exterior portion of the cardinal process in many Protremata. Its development does not begin until early neanic or later growth, and is probably secreted by the dorsal mantle lobe.

Crura.—Processes on the dorsal hinge plate of the Telotremata and some Protremata, to which are attached the fleshy brachia and brachidia. These usually form the inner walls of the dental sockets, and may be supported by septal plates.

Cruralium (Hall and Clarke).—The dorsal equivalent of the ventral spondylium, being formed by the convergence or union of the crural plates in the Pentameracea.

Delthyrium (Hall and Clarke).—The triangular aperture transecting medially the cardinal area, or the posterior surface from the apex to the posterior margin of the ventral valve, through some portion of which the pedicle passes. It has also been termed the *fissure* or *foramen*. The delthyrium may or may not be closed by a deltidium or deltidial plates.

Deltidium.—A plate of one piece which grows over the delthyrium of many Protremata and some Neotremata. In the early larval stage of Thecidium this plate begins as a secretion from the dorsal side of the body segment, and becomes anchylosed to the ventral valve in the phylembronic stage, subsequent additions being secreted by the body wall and pedicle. The convex or concave central portion of the ventral cardinal area in some Atremata is not homologous with the deltidium. It is but a part of the area, and does not have its origin in the prodeltidium, as in Thecidium.

Deltidial plates.—Two plates growing medially from the walls of the delthyrium after neanic growth. These usually unite medially, and close the delthyrium more or less completely. They are restricted to the Telotremata, and are secreted by extensions of the ventral mantle lobe. Hall and Clarke introduced the terms *deltarium* and *deltaria* for the same plates, and for the coalesced condition of the deltaria, Bronn's *pseudodeltidium*.

Dental plates.—Vertical plates supporting the teeth of the ventral valve.

Dental sockets.—Excavations in the dorsal cardinal margin in which the teeth of the ventral valve articulate. The inner wall of the socket is elevated and forms the base of the crural plate.

Diductor muscles.—In the Protremata and Telotremata the principal pair of diductor muscles has the larger end attached to the ventral valve near the anterior edge of the visceral area, while the other end has its insertion on the anterior portion of the cardinal process. There is another pair of small accessory diductor muscles, but these are seldom shown in fossil shells. By contraction these muscles open the valves.

Dorsal valve.—Usually the smaller and imperforate valve and the one to which the brachia are always attached. *Brachial*, *hæmal*, *socket*, and *entering* valves are other terms more rarely employed.

Ephebic (Hyatt, emend. Bather and Buckman).—Designating the mature shell.

Foramen.—A small circular passage through the deltidium or deltidial plates, either below or at the apex of the ventral valve. Sometimes the foramen encroaches by abrasion upon the umbo of the ventral valve.

Genital markings.—Radial markings or pits within the posterior portion of the visceral space, indicating the position and extent of the genitalia.

Gerontic (Hyatt, emend. Bather and Buckman).—Designating old age. It is indicated in the ontogeny of many species of brachiopods by extreme thickness of the valves, obesity, or by numerous, crowded growth lines near the anterior margin, a condition which sometimes produces truncation and absence of striæ at the margin.

Hinge line.—The line along which articulation takes place.

Jugum (Hall and Clarke).—The transverse band and its accessory processes uniting the spiralia. When this band is medially incomplete the parts are termed *jugal processes.*

Lateral areas.—That portion of the shell on each side of the ventral axis.

Listrium (Hall and Clarke).—In some Neotremata a plate closing the progressive track of the pedicle opening or pedicle cleft, posterior to the apex of the ventral valve.

Longitudinal axis.—A median line through the shell from the beak to the opposite margin.

Loop.—The calcareous brachial supports of the Terebratulacea. It is usually composed of descending and ascending lamellæ, united by a transverse band.

Median septum.—An internal vertical plate commonly developed along the vertical axis and between the muscles of the ventral valve. Sometimes there is also a dorsal median septum. Lateral septa are rarely developed.

Neanic (Hyatt, emend. Bather and Buckman).—Designating youthfulness, or the stage in which specific characters begin to develop.

Nepionic (Hyatt).—Designating the smooth-shell stage succeeding the protegulum.

Pallial sinuses.—Two convergent or divergent primary sinuses of the circulatory system, traversing the mantle and originating in the posterior medial region. They usually have numerous secondary branches, and both often leave impressions in the shell.

Pedicle.—The flexible muscular organ of the ventral valve by means of which brachiopods may be attached to extraneous objects.

Pedicle muscles.—In the Protremata and Telotremata one pair originates on the ventral valve at points just outside and behind the diductors and another on the dorsal valve behind the posterior adductors, while the opposite ends of both are attached to the pedicle. Besides these, there is an unpaired muscle lying at the base of the pedicle, attaching it closely to the ventral valve.

Platform.—See *Spondylium.*

Posterior region.—That portion of the shell back of the transverse axis and toward the beak, or apex.

Primary lamellæ.—The primary descending bands of the spiralia, the posterior ends being attached to the crura.

Prodeltidium (Hall and Clarke restricted).—The third shell plate developed in the earlier embryonic growth of species of Atremata,

Neotremata, and Protremata, and subsequently becoming more or less firmly attached to either the dorsal (Atremata) or ventral valve.

Protegulum (Beecher).—The initial shell of brachiopods. It is smooth and of microscopic size, in outline being semicircular or arcuate, and without cardinal areas.

Protractor muscles.—In the Lingulacea one pair has the ventral ends fastened at the anterior extremity of the visceral area, extending backward and inserted near the lateral margin of the dorsal valve, outside the rotators. A second pair originates just behind the adductors of the ventral valve, and is inserted posterior to the first pair. These muscles draw the dorsal valve forward. They are apparently present in the Obolidæ and Trimerellidæ, but their position is different.

Pseudodeltidium.—Properly this term applies only to the united condition of the deltidid plates in the Protremata and Telotremata. It is provisionally applied to the concave or convex medial portion of the cardinal areas in Atremata and Protremata.

Retractor muscles.—In the Atremata these extend from the outer lateral margins of the visceral area in the ventral valve to its anterior extremity in the dorsal valve, and serve to readjust the dorsal shell.

Rotator muscles.—In Lingulacea these are situated posteriorly just in advance of the umbonal muscle, two on one side and one on the other. By their contraction the dorsal valve turns alternately first in one direction and then in the other.

Septal plates.—Plates supporting the crural processes, also known as *crural plates.*

Spondylium.—A plate in the Pentameracea, formed by the union of converging dental plates, to the upper surface of which are attached the adductor, diductor, and pedicle muscles. The spondylium may rest upon the ventral valve or may be supported by a median septum. This plate is rarely present in the Telotremata, but more commonly in the Atremata, where it is known as the *platform.* There is sometimes developed in the dorsal valve a plate similar in appearance to the spondylium, but different in origin, and known as the *cruralium.*

Spiralia (Beecher).—The calcareous spiral brachial supports in the Spiriferacea. A connecting jugum may be present or absent.

Syrinx.—A tubular structure developed in the delthyrium of some Spiriferacea, opening ventrally and partially inclosing the pedicle.

Teeth.—Two processes of the ventral valve of articulate brachiopods, serving for articulation.

Transverse axis.—A line through the shell from right to left, midway between the beak and anterior margin.

Umbo.—The elevated or prominent portion of the valve anterior to the apex.

Umbonal muscle.—A single muscle situated in the umbonal region of most Atremata. By its contraction the valves are opened anteriorly. In Obolus this muscle divides toward the ventral valve.

Umbonal slopes.—The inclined surfaces about the umbo and opposite the cardinal slopes.

Ventral valve.—The valve situated on the ventral side of the animal, and having in youth or maturity a delthyrium or pedicle opening through which the pedicle is protruded, except in Iphidea, Obolella, Lingula, etc., where the pedicle protrudes between the valves. When the shell is cemented to foreign bodies it is always by the ventral valve. It is usually the larger and deeper of the two valves. *Pedicle, larger, dental, neural,* and *receiving* valves are synonymous terms.

CHAPTER III.

BIOLOGIC DEVELOPMENT OF THE BRACHIOPODA.

ORDINAL DEVELOPMENT.

ATREMATA.

This order, which began in the Lower Cambrian, is represented by 199 species, or over 10 per cent of American Paleozoic brachiopods. Its greatest representation, both in species and genera, was during the Cambrian and Ordovician eras. A very marked decline set in during the Silurian and Devonian, with almost extinction in the Carboniferous, where only Lingula and its subgenus Glossina occur.

The terminal families Trimerellidæ and Lingulidæ contain species which attain the greatest individual growth. Lingulidæ has the longest phylogenetic history. It is the last important and most specialized family of the Atremata, and manifests the greatest persistency and specific differentiation. Lingula, the essential genus of the family, lived at least from the Ordovician system through all succeeding time, and is represented in modern seas. During this enormous period the only change observable is that in the ancient forms the viscera occupied a little more and the brachia somewhat less space.

In the more primitive types of Atremata, Obolacea, the shell is usually much thicker and less chitinous than in the higher or derived families, Lingulacea. The shell is thickest in the Trimerellidæ and thinnest in the Lingulidæ. From their mode of occurrence in rocks it seems probable that Paterinidæ, Obolidæ, and Trimerellidæ (=Obolacea) never lived in the mud or sand of the sea bottom, as did Lingulidæ, Lingulasmatidæ, and probably Lingulellidæ (=Lingulacea).[1] The oboloids in all probability had short pedicles, while the linguloids have very long pedicles. The long, flexible, tubular pedicle of Lingula, associated with the buried habit of the animal, apparently explains

[1]Since all the species of Obolacea are known only as fossils, it may seem hazardous to ascribe to them a mode of living different from that of Lingula. These shells had short peduncles, are round or oval, sometimes very gibbous, always comparatively thick shelled, and not decidedly phosphatic. The writer has never observed any species of this superfamily in situ transverse to sedimentation, or in other words "on edge." In the Lingulacea the peduncle is very long, and the shells are elongate quadrangular, triangular, spatulate, or acuminate, and, as a rule, are decidedly thin and phosphatic. Recent Lingulas all live partially buried in the sea bottom, and not infrequently fossil species are found in situ, on edge, with their apices downward. Lingulops and Lingulasma also have been observed situated on edge. The round, thick shells of Obolacea are strongly contrasted with the elongate thin shells of Lingulacea. These peculiarities are in all probability due to mechanical causes. The Linguloids, with their long, powerful, and flexible peduncles, are buried in the sediments, while the posteriorly pointed shell is an adaptation to the same end, caused by the frequent peduncular pulling on that part of the valves.

the cause for the thinness of the shell and the long, narrow, attenuated form of its valves.

The ontogeny of Obolella and Lingula shows that one branch developed directly from the Paterinidæ to Obolidæ and Trimerellidæ, while another branch began in the Obolidæ. The derived branch continued to diverge by changing the thick round shells of the radical stock into thin spatulate or elongate subquadrate valves, first in the Lingulellidæ and culminating in the Lingulidæ. The latter family then gave rise to Lingulasmatidæ, which, in accordance with the law of morphologic equivalents, developed some of the internal diagnostic characters of the terminal family of the first phylum in the platform of the Trimerellidæ.

Hall and Clarke refer the genera of Lingulasmatidæ to Trimerellidæ, and thus the latter family, as understood by them, embraces two stocks having widely separated origins. This is peculiar, since they clearly understand the independent origin of these stocks, as will be seen by the following quotation, but more particularly by their diagram.[1]

> There is no single feature in the entire group of the edentulous brachiopods so striking as the great platforms in Trimerella and its allies, and it is rarely that so beautiful and well established an illustration of the attainment of such a remarkable resultant along two distinct lines of development can be presented.

The writer holds that a natural family can have but one stock, a stock can have but one origin.

Nonfunctional articular processes are developed in this order in a number of genera and at various times. Such are slightly developed in Trimerella and Monomorella, and more strongly in Tomasina, Barroisella, and Spondylobolus. In the Neotremata, articulation is also approached in Trematobolus, and in Crania a false hinge is sometimes developed in Ordovician species. A cardinal process so characteristic of the Protremata and Telotremata is faintly developed in Neobolus, Lakmina, and Trimerella of the Atremata.

NEOTREMATA.

The order Neotremata begins in the Lower Cambrian, and is represented by 156 species, or over 8 per cent of the brachiopods of the American Paleozoic. It has considerably fewer species than the Atremata, and exhibits a lack of specific differentiation, such as form and surface ornamentation. This probably is largely due to the fact that the pedicle is very short, or even obsolete, in this order, and that the pedicle foramen is subcentral, producing in the Trematidæ and Craniidæ more or less of a parasitic growth, while in the families Discinidæ and Acrotretidæ the great majority of species are circular or oval, with more or less cone-shaped shells.

As in the Atremata, great tenacity of life is also manifested in this order, since its two essential families, Discinidæ and Craniidæ, have representatives throughout all time since the Ordovician system.

[1] Palæontology of New York, Vol. VIII, Part I, 1892, p. 165.

Greatest representation in both genera and species was during the Ordovician, after which generic differentiation was practically restricted to the Discinidæ and Craniidæ. Crania persisted throughout the post-Ordovician, and for longevity equals the atrematous genus Lingula.

The percentage of widely dispersed species is about the same as in the Atremata, and likewise is greatest in those families with the longest phylogenetic history, as Acrotretidæ, Discinidæ, and Craniidæ.

Development was along two lines. In one a broad fissure (the most primitive condition of the pedicle opening in this order) is retained as a mature character (Trematidæ). Later geologically, and at the maturity of the individual in derived forms, the fissure is gradually closed posteriorly, leaving a long, narrow slit, at one end of which the pedicle emerges (Discinidæ). The other line (Acrotretacea) probably developed and inherited holoperipheral growth in the ventral valve, very rapidly producing a small subcentral circular foramen, since this feature is already well developed in the Lower Cambrian Acrotretidæ, and in advance of the greatest development of the Discinidæ. It is probably this second branch that gave origin to the degraded family Craniidæ. The protegulum in the dorsal valve of Acrotretacea is probably always marginal, whereas in the Discinacea it is always more or less central.

It is remarkable that Crania, so unlike other living brachiopods and occurring abundantly in the seas of to-day, has never been completely studied developmentally or ontogenetically. The taxonomic position of the Craniidæ is therefore not actually determined, and Hall and Clarke incline to follow Waagen in regarding the Craniacea as equivalent in rank to the Atremata and Neotremata. These authors write:[1]

> It is nevertheless to be observed that no trace of a former pedicle-slit incision or perforation is found on mature or immature shells, and it would be difficult to comprehend in what manner such an essential modification of the shell could be wholly concealed by later growth. Were the pedicle marginal in primitive growth stages and subsequently atrophied, the obliteration of the marginal opening by later resorption and growth would be a readily intelligible process. There is, hence, in this default of evidence, a good reason to doubt the close affinities of Crania and Pholidops to the Diacaulia [= Neotremata]. Present knowledge would seem to indicate that they were primarily of the type of the Mesocaulia [= Atremata], and that their resemblance to the Diacaulia is wholly of secondary growth. Waagen's term for this group, Gastropegmata (or Craniacea), may therefore prove to be equivalent to each of these other two divisions.

Brachiopod embryology demands a pedicle in the early stages of Crania. The ventral valve carries the pedicle, and it is always this valve which is attached by cementation or otherwise. The writer has observed in Yale University Museum a specimen of *Pholidops ovata* with a cicatrix of attachment, around which point growth is holoperipheral as in all Neotremata. Specimens of Pholidops are sometimes preserved with both valves in position and delicately attached to Bryozoa

[1] Paleontology of New York, Vol. VIII, Part II, 1895, p. 325.

from the Falls of the Ohio. These are believed to be actual and not chance attachments. In Crania cementation occurs very early and is complete, causing all obliteration of the protegulum and subsequent stages of growth in the ventral shell. That cementation does obliterate nearly all the younger characters is also shown in the remarkable genera Richthofenia and Ostrea. On the interior of Pholidops and Crania the four large muscular scars, which are more those of the Neotremata than of the Atremata, are arranged medially, in the center of which, probably, was the pedicle opening. Some proof of this is seen in the excavated, posteriorly terminating muscular pit of *Crania ignabergensis*, which, if carried through the valve, will make the pedicle opening subcentral and surrounded by shell deposit. If an Acrotreta, Linnarssonia, or Conotreta became cemented, there would result practically a Crania. In no atrematous brachiopod is there the slightest indication of cementation, but where shell fixation does occur it is always (excepting in Zugmeyeria and Thecocyrtella) in such as have the pedicle very early surrounded by shell matter, as in the Strophomenidæ and Productidæ. For these reasons the characters of Craniacea seem more in accord with the Neotremata than with the Atremata. The characters of Craniacea are certainly not of ordinal importance, and possibly not even of superfamily value.

In the development of its pedicle foramen the family Siphonotretidæ is unlike any other of this order. During neanic growth the pedicle opening was posterior to the protegulum, but later it gradually moves anteriorly through the shell by resorption, producing a narrow slit similar in appearance to that of the Discinidæ. A pedicle foramen of the same nature is also developed in Eichwaldia and Dictyonella of the Protremata. As yet no explanation has been given as to the causes producing this aberrant development.* The writer suggests that since these animals had delicate peduncles, with the shell elongate oval and sometimes cone-shaped in form, they probably stood nearly upright on their pedicles in early growth. Shell accretion being more rapid anteriorly, with the ventral side of the animal the larger and heavier, a tendency was initiated for the shell to lean against the ventral side of the peduncle. This pressure would produce resorption of the ventral shell anterior to the pedicle, and eventually, this tendency becoming hereditary, the ventral valve would lie nearly flat, with the pedicle emerging at a great angle subcentrally.

PROTREMATA.

This order is represented by 738 species, or nearly 40 per cent of American Paleozoic brachiopods, and is eminently characteristic of the post-Cambrian Paleozoic systems. Like the Atremata and Neotremata, it is represented in the Lower Cambrian. It was not, however, until Ordovician times that the Protremata attained very rapid evolution. In the Cambrian there are but 4 genera and 22 species, while in

the Ordovician there are 20 genera and 173 species, a specific increase of more than seven and one-half times the number in the Cambrian. Greatest generic differentiation occurred during the Silurian, where 30 genera appear. Then began a steady decline, with extinction in the Carboniferous of North America. In the Triassic of Europe this order is sparingly represented by small species, and is there essentially restricted to the family Thecidiidæ, which continues to have living representatives in the Mediterranean Sea.

The widely distributed species gradually increase in percentage from 14 in the Cambrian to 36 in the Carboniferous, and are most marked in the family Productidæ. This family is one of the last of the order to originate.

The largest of all brachiopods occur in this order, in the families Pentameridæ and Productidæ, exceeding the Spiriferidæ of the Telotremata. In the former family greatest size is attained in the Silurian during the acme of the order, and in the Productidæ in the Carboniferous system. *Productus giganteus* of the Lower Carboniferous is the giant of all brachiopods, attaining a diameter of nearly 1 foot. In both these families the earliest species are small, but certain groups gradually attain larger and larger size with geologic time. Upon the appearance of the giants, vitality of the families, as exemplified in specific differentiation and robustness of individuals, is at its highest. After this these families rapidly decline, and the species dwarf far more rapidly than they developed to the climax.

In the Protremata, as in the two previous orders, greatest specific differentiation does not occur in the radical families, but in those of later development. The Kutorginidæ, Clitambonitidæ, and Billingsellidæ are the radical and, geologically, the oldest families of the Protremata. These are best but sparingly developed in the Cambrian, whereas the younger families, Pentameridæ, Strophomenidæ, Productidæ, and Orthidæ, contain over 95 per cent of the species and nearly 90 per cent of the genera. Orthidæ and Strophomenidæ, beginning in the Cambrian, are best developed in the Ordovician and Silurian systems, respectively; while Productidæ, originating in the Silurian, attained a climax in the Carboniferous. The latter family was one of the last of the Protremata to originate and has the shortest geologic history and least generic differentiation, yet many of its species have greater geographic dispersion.

The Protremata are clearly divisible into two phyla, Strophomenacea and Pentameracea. The former superfamily has the greater number of species, and is characterized by the nondevelopment of a spondylium or cruralium. The Pentameracea has, in addition to the deltidium, an internal spoon-shaped plate, or spondylium, serving for the attachment of muscles, and a discrete or united cruralium. The superfamily Strophomenacea in North America has 608 species, and represents the most primitive phylum, since it is far better developed in the Cambrian than

is the Pentameracea, and has almost without exception a straight cardinal area. The Pentameracea has 127 species, and its earliest forms also have straight hinge-lines in the 16 species of the families Clitambonitidæ and Syntrophiidæ; but the rostrate family Pentameridæ, which attained maximum development in the Silurian, has 87 species. The Strophomenacea has living species, while the Pentameracea disappeared with the Permian. The cause for the rapid extinction of the latter is probably due to the high degree of specialization expressed by the spondylium.

Two well-marked types of shell form are developed in this order. By far the most prominent is the group which includes the long-hinge families Kutorginidæ, Clitambonitidæ, Billingsellidæ, Strophomenidæ, Productidæ, Thecidiidæ, and Orthidæ. The other group, represented by Pentameridæ, is largely rostrate in form, but occasionally also develops a straight hinge line. This, however, is never so prominent as in the former group. In the Telotremata the general form is rostrate, but very notable exceptions are present in the families Spiriferidæ and Terebratellidæ, and occasionally in the Rhynchonellidæ and Athyridæ. The form of the shell, however, has no great taxonomic value, and can not be accorded more than generic rank. The predominating type of shell form within an order probably has phyletic value, since the oldest protrematous shells are long-hinged, while the telotrematous shells are usually rostrate. Nevertheless, as indicated above, in the derived forms of both orders there are notable exceptions, and these changes are probably always induced by shortening or lengthening of the peduncles. Since Orthorhynchula has a well-developed cardinal area, it is not in itself "evidence of the first significance as indicating the source from which the extensive group of the Rhynchonellas originated."[1] The oldest rhynchonelloids are rostrate shells (*Protorhyncha? minor* and *P. ? ambigua* of the Lower Cambrian), and the ontogeny of several species of Rhynchonella and of Zygospira has not revealed a long-hinged stage with cardinal areas. There is, therefore, no conclusive proof for the deduction of Hall and Clarke, "that some of the Rhynchonellidæ, early in their [geologic] history, occasionally retain a well-defined cardinal area, and that, in default of other evidence, the presence of this character may be regarded as indicative of the common origin of Orthis, the Strophomenidæ, and the Rhynchonellas."[2]

In this order far more than in any other is found the closure of the pedicle passage and atrophy of the pedicle, together with peculiar special adaptations which entirely or partially replace the functions of the pedicle. In the family Productidæ the ventral shell develops more or less abundant tubular spines, either along the cardinal line or over the entire valve. These are always most abundant in, or are

[1] Palæontology of New York, Vol. VIII, Part II, 1895, p. 336.

[2] Ibid., p. 342. For further remarks bearing on this subject, see pages 93–95 on the significance of the prodeltidium.

restricted to, the posterior region. The functions of the spines are to hold the animal to its place of habitation, for there is no apparent pedicle opening in these shells when mature. In others of the same family the ventral apex is cemented to extraneous objects (Strophalosia), and in still others the spines clasp the object of support when small (*Strophalosia goldfussi* and Etheridgina). In the Strophomenidæ the older species all seem to have functional pedicles throughout life, but in the Devonian, forms occur in which the apex is cemented to foreign objects (Leptænisca). Some of the Middle and Upper Devonian Stropheodontas show no trace of a pedicle opening when adult. In the Carboniferous cementation is far more common, and occurs in Derbya and Streptorhynchus; and when taken in connection with Strophalosia, Chonostrophia, Aulosteges, and Richthofenia, it is seen that nearly all the contemporaneous species of this order have developed other methods for fixation than the normal one. In Richthofenia calcareous cementation is complete, and the modifications resulting therefrom have so changed the shell that the lower or fixed valve is very suggestive of a cyathophylloid coral, not only in form but even in shell structure.

The chief cause for atrophy of the pedicle lies not only in the fact that this organ, in all long-hinged brachiopods, is short, but more particularly in the fact that throughout this order, and in the Acrotretacea of the Neotremata, the young shells always have the pedicle completely surrounded by shell, and thus to a great extent limit its growth. Even among the Orthidæ, where the species geologically older often have thick pedicles, which is indicated by the large open delthyrium, they gradually diminish in size throughout the Paleozoic. In the Strophomenidæ the pedicle is never a thick organ, and shortly after this family gives rise to the Productidæ, in Chonetes, the first appearance of cementation takes place. This mode of attachment constantly increases in the different phyla to the end of the family histories. In the Productidæ the early inheritance of a weak pedicle soon leads to its complete loss by the additional fixation developed. This additional fixation has its first appearance in the cardinal spines of Chonetes, which are periodically developed by mantle extensions. The degeneracy of the pedicle, once well established, is inherited at earlier and earlier periods by acceleration. The spines become more numerous, and are finally developed over the entire ventral valve. In the dorsal valve, the spines are never so long as in the ventral valve, and often are not developed at all, but are replaced by numerous concentric overlapping lamellæ. As the spines begin to develop more numerously and longer, the ventral valve attains more convexity, with a strongly incurved beak and the complete loss of a pedicle opening. Productus, therefore, does not stand erect on the cardinal areas, as in Chonetes, but lies on the ventral shell, anchored by the numerous spines. The spines are of the same nature as the shells, and never flexible. When

they came in contact with hard objects during their growth, they followed along or clasped the object of support.

The slender shell-incased pedicle of the Strophomenacea probably leads to the growth of long, straight hinges for additional support, further weakening the pedicle and necessitating accessory fixation in four of its families, and finally occasioning in many species complete loss of this organ at the maturity of the individual. With the exception of the Thecidiidæ, the order Protremata has become nearly extinct since the Jurassic era.

TELOTREMATA.

This order, though but 2 Cambrian and 20 Ordovician forms are known, is represented by 766 species, or about 41 per cent of all American Paleozoic brachiopods. It is as well developed specifically as the Protremata, and exhibits a far greater variety of structures. Telotremata was probably the last order to originate, and has the greatest number and variety of living species. Its highest development is in the Devonian, where 369 species in 50 genera occur, while 109 species are known from the Silurian, a growth more than five times greater than that of the Ordovician system. Here, too, as in the Protremata, considerable time was consumed in establishing a few primitive characters, and these are no sooner obtained than an almost sudden development of great specific and generic differentiation takes place.

It is highly probable that no telotrematous Paleozoic genus continued to live through half the geologic time that Lingula and Crania did. Rhynchonella, a primitive genus of this order, is often said to have continued since the Ordovician, and Terebratula since the Devonian, era. This is now very doubtful, since Hall and Clarke have demonstrated that in all of the Paleozoic forms of these genera where it has been possible to examine their interiors none belong to Rhynchonella or Terebratula. In this catalogue both genera are recognized as occurring in the Paleozoic, but this is due to the fact that the internal structure of those species is not known.

Telotremata has three distinct types of brachial supports, which readily serve to differentiate 3 superfamilies. The simplest, Rhynchonellacea, has but crura, and is represented in the American Paleozoic by 14 genera and 202 species, of which 66 are widely distributed. The superfamily Terebratulacea, having more or less simple V or W shaped brachial supports, is present with 19 genera and 78 species, of which 23 are widely distributed. In the structurally more complex superfamily Spiriferacea, having spiral brachial supports, there are 41 genera and 466 species, and of these 161 become widely distributed. This again confirms the previously noted fact that the groups latest developed have the greatest generic and specific differentiation. In Spiriferacea this likewise occurred in the family Athyridæ.

If the percentage of widely distributed species within a superfamily is a criterion of its vitality, it will be seen that the Rynchonellacea begin in the Ordovician with 50 per cent and decline to 23 per cent in the Carboniferous. The Spiriferacea, also beginning in the Ordovician, have 50 per cent of their species widely distributed, becoming reduced to 20 per cent in the Carboniferous. On the other hand, the Terebratulacea were not widely dispersed in the Silurian, whereas in the Devonian their distribution reached nearly 30, increasing to 34 per cent in the Carboniferous. Since no statistics of the European Mesozoic and Cenozoic species of this nature are available, the writer can not determine whether or not the Rhynchonellacea continue to decline with such rapidity. It is known, however, that this superfamily has declined considerably in the Cenozoic and late Mesozoic. After the Triassic the Spiriferacea are essentially represented by Spiriferina, yet it too died out with the Jurassic, while the Terebratulacea, which manifested progressively greater vitality during the Paleozoic, are believed to have continued so nearly throughout the Mesozoic into late Cretaceous time. Since then, however, they have also declined.

In the ontogeny of Dielasma and Zygospira—loop-bearing and spire-bearing genera respectively—Dr. Beecher and the writer have shown that the Terebratulacea may not have been the last superfamily to develop, as was formerly supposed, and that it may have given rise, during early Ordovician times, to the spire-bearing superfamily Spiriferacea. The Terebratulacea probably originated in the Rhynchonellacea, though no loop-bearing species are known until the spire-bearing forms are well advanced, or until early in the Devonian system. While some of the largest species of Terebratulacea are found in the Devonian of America and Europe, yet throughout the Paleozoic this superfamily is not a conspicuous one. In the Jurassic and Cretaceous systems of Europe, however, great specific differentiation and abundant individual development took place. There is but 1 species of this superfamily in the American Silurian, while the Devonian has 50 species in 15 genera, an increase fifty times greater than that of the Silurian. In the Carboniferous a sharp decline set in, and the superfamily is reduced to 30 species and 8 genera.

These facts suggest that either the superfamily Terebratulacea did not originate in American seas or—which seems less probable—that diminutive species occur whose interior characters have escaped detection. Further, since the earliest American primitive genera, Rensselæria and Trigeria of the Lower Devonian, have very large species, neither these nor Centronella can be the earliest adult representatives of this superfamily. When quite young, Zygospira, also, has a "centronella-like loop," and it is possible that the primitive Terebratulacea had their origin before the earliest appearance of Zygospira, or during the earliest part of the middle Ordovician era.

The great majority of telotrematous genera are rostrate in form, but

at different times and in separate phyla straight cardinal areas are more or less well developed. In America, the oldest members of this order (*Protorhyncha? minor* and *P.? ambigua*, members of the family Rhynchonellidæ) occur in the Lower Cambrian. In these species, and in the great majority of this family, there is no cardinal area; but occasionally this character is present, the earliest conspicuous example being the Ordovician genus Orthorhynchula. Among the Paleozoic Terebratulacea cardinal areas are seldom developed. A conspicuous exception, however, occurs in Tropidoleptus. But in the Mesozoic and Cenozoic, in the family Terebratellidæ, cardinal areas are very often present, and in living forms are accompanied by a short pedicle. It is, moreover, in the Spiriferacea, the youngest superfamily of the Telotremata to originate, that the greatest development of cardinal areas takes place. The oldest genera of the Spiriferacea are all rostrate, as in the Ordovician Zygospira, Catazyga, and Cyclospira. In the Silurian the Spiriferidæ tend to develop rapidly long, straight, and wide cardinal areas, attaining greatest development in the Devonian and early Carboniferous. This excessive development of cardinal areas is no doubt due to the shortening and decline of the pedicle, since in the Triassic system forms occur in which cementation is complete (Zugmeyeria and Thecocyrtella). Cardinal areas are also developed in other families of the Spiriferacea, but in no case can such be traced to Ordovician long-hinged ancestors.

In this order, more than in the Protremata, internal specialization of the brachia has progressed from a simple to a highly complex condition. In the Protremata, in its latest developed superfamily, Pentameracea, crura are also present, of the same phase of development attained by the Rhynchonellacea, the most primitive superfamily of the Telotremata. In this order, however, there are, with but few exceptions, no internal special structures, as spondylia. The specialization in the Telotremata is expressed in the progressive complication of the calcareous brachial supports. In the most primitive species of the Rhynchonellacea no crura are present (Protorhyncha), but in all later forms these appendages are well developed, and finally in the Trias and Jura attain very great length in Rhynchonellina. In the next more complicated superfamily, Terebratulacea, the crura in the primitive members have united anteriorly, thus forming the simple unchanging loop of Centronella and Rensselæria, which is also known to occur in the very young of some species of the highest superfamily, the Spiriferacea. The geological history of the loop has shown that the brachia have been constantly changing, causing more or less complete resorption of the hard parts and adaptation to later requirements. The progressive development of the loop is also repeated ontogenetically and more or less fully in living terebratuloids.

In Zygospira, the oldest known genus of the suborder Spiriferacea, the primitive loop of Centronella is reproduced in the earliest phase in

the development of its brachidium. This is partially resorbed and changed in form, and to it is then added laterally the two spirals and medially the simple or, in the higher forms, the complex processes, or jugum. The volutions of the spirals in the oldest genera geologically are very few, but subsequently they become more numerous, and attain their maximum in the long-hinged Devonian and Carboniferous spirifers, where 35 volutions have been observed, with 24 in Atrypa.

The form of the paired spirals varies but little except under the necessity of conforming to the interior cavity of the valves. Their inclination and direction is a feature of much significance when considered with reference to the development of the entire shell. It is the loop, or to employ a term more appropriate in view of the homologies of the spire-bearing and loop-bearing shells, the *jugum*, however, which is subject to the most frequent variations in form, and which serves as the generic index. When the spirals are directed outward toward the lateral margins of the valves, the jugum seems to be much more variable than in shells where the spirals are introverted or take some intermediate position. In the latter there is a much greater variation in the position of the loop upon the primary lamellæ than occurs in the former.[1]

GENERAL DEVELOPMENT.

In the preceding pages it is shown that the four types of pedicle openings which serve as the prime characters in distinguishing the four orders, Atremata, Neotremata, Protremata, and Telotremata, are present in the oldest division of the Cambrian, the Olenellus zone. From the pre-Cambrian sedimentary rocks, or Algonkian system, practically no fossils are known, though there is evidence in them that life existed. The fact that the Olenellus zone has a varied marine fauna alone indicates that the sea during Algonkian times must have swarmed with living things. When the enormous time represented by the great thickness of North American pre-Cambrian sediments is considered, or that of Bohemia, it is evident that ample time elapsed for life to attain the degree of complexity manifested in the basal Cambrian zone. Kayser says that this pre-Cambrian time was "probably so long that the beginning of the Cambrian period may be considered as comparatively a recent event."[2] Van Hise, in writing on the same subject, says:[3]

If geological history were to be divided into three approximately equal divisions these divisions would not improbably be the time of the Archean, the time of the clastic series between the Archean and the Cambrian, and the time of Cambrian and post-Cambrian. In this connection it is well to recall that many years ago Logan suggested that the thickness of the Laurentian and Huronian may surpass that of all succeeding formations, and that the appearance of the so-called Primordial fauna may be considered as a comparatively modern event.

In the Lower Cambrian there are not many species of brachiopods nor is the specific differentiation in any order very varied, indicating

[1] Hall and Clarke, Palæontology of New York, Vol. VIII, Part II, 1895, p. 343.
[2] Text-Book of Comparative Geology, 1893, p. 13.
[3] Sixteenth Ann. Rept. U. S. Geol. Survey, Part I, 1896, p. 760.

either that evolution in pre-Cambrian eras was much slower than subsequently or that the class had its origin late in the Algonkian. Cambrian brachiopods usually differ fundamentally from one another, and do not appear to have been persistent, as but 4 of the 22 genera pass into the Ordovician. Differentiation also appears to have been slow during the Lower and Middle Cambrian, but toward the close of this system species begin to be more numerous and varied. In Middle Ordovician times all the orders and superfamilies are well established except Terebratulacea. The zenith of the class was attained in the Silurian and Devonian eras, but decline began during late Devonian, and steadily continued to the close of the Paleozoic. But 7 of the Carboniferous genera are known to have survived the break between the Paleozoic and Mesozoic. During the latter time the spire-bearing brachiopods pass out of existence, while the great Paleozoic superfamily Strophomenacea is represented by a few small species of the Thecidiidæ, which continue to be represented up to the present time. After the Cretaceous system the orders Atremata, Neotremata, and Protremata are represented only by Lingula, Discina, Discinisca, Crania, and Thecidium. The Terebratulidæ may have had their inception below the middle of the Ordovician, but are not a pronounced Paleozoic group. However, in the Jurassic and Cretaceous systems the rocks abound with the shells of this family, and from that time on they are the chief representatives of the class. Lingula and Crania are present in the Ordovician, and, as far as can be determined, have persisted to the present time.

Of the 49 families and subfamilies constituting the class, 43 became differentiated in the Paleozoic, and of these 30 disappeared with it, while but 13 continued from the Paleozoic into the Mesozoic. Of Paleozoic families, 6 are represented by living species, viz, Lingulidæ, Discinidæ, Craniidæ, Thecidiidæ, Rhynchonellidæ, and Terebratulidæ.

Of the 327 genera now in use, 227 had their origin in Paleozoic seas, or nearly 70 per cent of the entire class, and of this great number but 8 are positively known to pass into the Mesozoic, viz, Lingula, Orbiculoidea, Crania, Rhynchonella, Spiriferina, Athyris, Terebratula, and Hemiptychina. Besides these, Streptorhynchus, Cyrtina, Retzia, Martinia, and Martiniopsis, are mentioned as occurring in the Triassic, but these species probably in great part belong to other genera.

The Atremata, which contains the oldest and the simplest forms structurally, is represented by 29 genera, while the Neotremata and Protremata have 30 and 89, respectively. Telotremata is the last order to appear, and has by far the greatest number of genera, 179.

The chronogenetic history of brachiopods shows that the four orders begin with smooth shells, and that subsequently various kinds of surface ornamentation are developed or disappear with varying degrees of rapidity. The ontogeny of strongly plicated and lamellose shells, wherever observed, begins with smooth shells. All new surface characters

are first introduced during adolescent growth or senility, and these by the law of acceleration appear earlier and earlier in later species. In the Lower Cambrian there are species of Billingsella with a few broad undulations in the shell, but in the Middle Cambrian the plications are pronounced and cover half or more than half the anterior portion of the valves, while in the Upper Cambrian these folds appear upon the umbones. In the oldest rostrate pentameroids the shells are either smooth or have a few folds (Camarella), which become more distinct in Parastrophia, and culminate in numerous sharp plications in Anastrophia. The rhynchonelloids, beginning in Protorthis of the Lower Cambrian as smooth shells, gradually become more and more plicated in the Silurian and Devonian, yet in the Triassic many species again appear nearly smooth.

STRUCTURAL CHARACTERS.

THE PROTEGULUM.

The order Atremata is the radical brachiopodous stock, which early in its history gave origin more or less directly to the other three orders of brachiopods. Beecher has observed:[1]

> That all brachiopods, so far as studied by the writer, have a common form of embryonic shell, which may be termed the protegulum. The protegulum is semicircular or semielliptical in outline, with a straight or arcuate hinge line, and no hinge area. A slight posterior gaping is produced by the ventral valve being usually more convex than the brachial. The modifications noted are apparently due to accelerated growth, by which characters primarily nealogic [=neanic] become so advanced in the devolopment of the individual as to be impressed finally upon the embryonic shell. This feature is well shown in the development of Orbiculoidea and Discinisca.
>
> As the protegulum has been observed in about 40 genera, representing nearly all the leading families of the class, its general presence may be safely assumed. [In structure it is corneous and imperforate and varies in size from 0.05 to 0.60mm. The] prototype preserving throughout its development the main features of the protegulum, and showing no separate or distinct stages of growth [is found in the Lower Cambrian genus Paterina]. The resemblance of this form to the protegulum of other brachiopods is very marked and significant, as it represents a mature type having only the common embryonal features of other genera.

Since the above was written Mr. C. D. Walcott has shown that the type species of Paterina has a well-developed cardinal area, and that it is synonymous with Iphidea.[2] The latter, however, is generally assumed to have an apical pedicle opening as in the Acrotretidæ. This is now known not to be the case. The supposed perforation is but a slight depression or short groove in the apex of the ventral valve, and does not pass through the shell. Iphidea is therefore in harmony with Paterina, since both have more or less well-developed cardinal areas. The theoretical Paterina or prototype of the protegulum is therefore

[1] Am. Jour. Sci., April, 1891, 3d series, Vol. XLI, pp. 344–346.
[2] Proc. U. S. Nat. Mus., Vol, XIX, 1897, pp. 707–713.

not yet known. It is evident, however, from the material Mr. Walcott possesses, that Iphidea-like forms will be discovered in which the cardinal area is undeveloped and in harmony with the protegulum. It is in this sense that the terms Paterina and paterina stage are used throughout this work.

THE PRODELTIDIUM.

The term prodeltidium is applied by Hall and Clarke to the third shell plate originating on the dorsal side of the body wall in the cephalula stage of *Thecidium mediterraneum*, the only living species of Protremata. This plate, however, is not restricted to that order, but has been observed by authors as also occurring in the Atremata and Neotremata. The term prodeltidium is here applied to this embryonic plate wherever it occurs unmodified.

Beecher has shown that the prodeltidium in the Protremata is the first cause for the development of the deltidium so characteristic of this order. That this plate is also present in the Neotremata is apparent from the description of a brachiopod larva of Discina (= Discinisca) given by Fritz Mueller. These larvæ were captured in abundance off Desterro or Santa Cathrina, Brazil, but Mueller was not so successful as Kovalevsky and others in securing the earlier larval stages of other genera developing in the brood pouch, and therefore nothing is known as to the place of origin of the prodeltidium in Neotremata. Since, however, the prodeltidium is also present in young Lingula of the order Atremata, where it is wholly attached to the interior of the dorsal shell, it appears safe to assume that this plate invariably develops on the dorsal side of the thoracic segment of embryonic brachiopods, and later becomes attached either to the dorsal (Atremata) or ventral valve (Neotremata and Protremata), except where, as in the Telotremata, it does not occur.

Before taking up the phylogenetic significance of the prodeltidium, it will be advisable to state what is known of this plate in the Atremata and Neotremata. Since it was first discovered by Fritz Mueller in the Neotremata, where also it is best developed, and subsequently was homologized by Brooks with a similar plate in Glottidia, it will here be given first consideration. Mueller writes:[1]

> Mit ihrem Hinterrande dem ausgebuchteten Hinterrande des Bauchshale anliegend, gewahrt man zwischen den Schalen eine *querovale Platte*, 0.06 mm. lang, 0.11 breit, mit dunklerem, oft braunröthlich gefärbtem, ringförmigen Rande. Sie haftet an der Bauchschale, deren Bewegungen sie folgt, und steht mit der Rückenschale nur durch Muskeln in Verbindung.

There is, then, in this Discinisca, a transversely oval plate somewhat loosely attached to the ventral shell near its posterior margin, the movements of which it follows. Mueller adds:[2]

> Die querovale Platte tritt unter des bis zum Vorderrande der Rückenschale vorgeschobenen Bauchschale vor, beginnt sich nach hinten zu verlangeren und ein faseriges Ansehen zu zeigen (Stiel?); sie folgt, nach wie vor, den Bewegungen der Bauchschale.

[1] *Archiv Anat., Physiol., 1860*, p. 74. [2] Ibid., p. 78.

Since in this stage of Discinisca there is no pedicle present, Mueller apparently was disposed to regard the prodeltidium as the equivalent of the pedicle. That this is an erroneous interpretation seems certain, for in his second paper he states:[1]

Die bis dahin zwischen den Schalen verborgene querovale Platte (der Stiel) tritt hervor, indem sie sich wie es scheint, um dem ausgebuchten Hinterrande des Bauchschale vollständig herumdreht und so ihr vorderer Rand zum hinteren wird.

In Glottidia the pedicle does not appear until sometime after the prodeltidium is developed, and it seems reasonable to assume from the description of Mueller that, on the development of the pedicle, the prodeltidium is pushed and turned backward, and between this and the notched ventral margin the pedicle passes. The pedicle opening at this stage is therefore surrounded by shell matter, anteriorly by the protegulum and posteriorly by the prodeltidium, characters duplicated in Thecidium. In the latter genus the prodeltidium develops into the deltidium, whereas, according to Mueller, this plate subsequently disappears in Discinisca. Brooks, also, is not disposed to accept Mueller's interpretation of this plate as the pedicle, since he writes:[2]

If it is the same [the transversely oval plate of Discinisca and the dorsal semicircular plate of Glottidia], Mueller is certainly in error in his suggestion that it is the peduncle, for there is no connection between the two structures.

In *Glottidia pyramidata*, Brooks has shown that the prodeltidium is also present, yet here it does not become attached to the ventral shell, but is firmly fastened to the dorsal valve, and this apparently was consummated in the paternia stage. Brooks writes:

I was not able to learn anything of the significance of the semicircular plate shown in figures 1 and 3. It is found only in the dorsal valve, and is either a mark upon its inner surface or a plate between the body and the valve. According to Fritz Mueller, the Brachiopod larva studied by him possessed a similar structure. * * * The embryo of Lingula is so small and thin that if this were a separate plate, it would be rather difficult to prove without seeing it move, or find it bent outward. In the absence of such evidence, we seem warranted in concluding that it is a similar structure to the movable plates of Mueller's larva, although, in Lingula at least, it is in connection with the dorsal, not the ventral valve.

No one has yet mentioned the presence of the prodeltidium in living Telotremata, and it may prove to be absent in this order, as it is not developed in the three species carefully studied by Morse, Kovalevesky, and Shipley.

Recapitulation.—The prodeltidium is present in Atremata, Neotremata, and Protremata. In the embryonic brachiopods developing this plate it is first found on the dorsal side of the body wall, and later is anchylosed to the ventral shell in Protremata (Thecidium). In the Neotremata, the earliest embryonic stages of which are not known, it is found completely developed and loosely attached to the ventral shell, anterior to the posterior margin. It subsequently turns backward to

[1] Archiv für Naturgesch., 1861, p. 54.

[2] Chesapeake Zoological Laboratory, session of 1878; Johns Hopkins University, 1879.

the posterior margin of the same valve, and the pedicle is believed to emerge between the plate and the valve (Discinisca). The prodeltidium is therefore alike in final position in the Neotremata and Protremata. In the Atremata this plate is either attached by its entire surface or by the posterior margin only to the dorsal shell, as in Glottidia, where the earliest embryonic stages are also unknown. The prodeltidium is likewise dorsal in the cephalula stage of Thecidium (Protremata), but subsequently is attached to the ventral shell, yet in reality remains dorsal to the animal. In Glottidia (Atremata) this plate remains attached to the dorsal valve, and in nowise affects the pedicle opening, as in the Neotremata and Protremata. In the Telotremata the prodeltidium has not been observed, nor has any fossil species in this order shown the least trace of a deltidium, and wherever the delthyrium is closed it is always by plates growing medially from its walls, secreted by the mantle and never by the peduncle. Therefore, when the prodeltidium remains stationary or with the dorsal valve, it is not known that this plate affects the original pedicle opening (Atremata and Telotremata), but when subsequently attached to the ventral valve and partly surrounds the pedicle with shell matter, it completely modifies the primitive pedicle opening by restricting it to the ventral shell (Neotremata and Protremata). In the derived or later-appearing families of the Neotremata and Protremata the effects of foraminal modification initiated by the prodeltidium may be wholly lost, as in Craniidæ and Orthiidæ.

SIGNIFICANCE OF THE PRODELTIDIUM.

The deltidium is the chief character of ordinal importance in the Protremata, and since this plate is attached to the ventral valve, yet originates in the dorsal prodeltidium, it seems reasonable to assume that if similar developmental conditions are found in other orders such orders would possess closer phylogenetic relationship than those having differing conditions. It has been shown that the prodeltidium is also attached to the ventral valve in the Neotremata, and so far both orders show relationship in their earliest embryonic growth. Beecher has shown that the protegulum or initial shell of the Protremata is discinoid in form and more like that of the Neotremata than that of the Atremata or Telotremata. He writes:[1]

> Discinisca shows a subcircular ventral protegulum with a pedicle notch, and the evidence of any hinge in the dorsal protegulum is very slight. The discinoid character appearing in the second and third nepionic stage of the Paleozoic Orbiculoidea has become so accelerated in Neozoic and recent Discinisca as to produce a discinoid protegulum.
>
> The strophomenoid shells usually retain a normal protegulum in the dorsal valve, but from the acceleration of the discinoid stage in the ventral valve the protegulum, has an abbreviate hinge and arcuate hinge line. (P. 346.)
>
> The nepionic stage of *Leptæna rhomboidalis* is represented by a shell without radii, having a comparatively large pedicle opening in the ventral valve and a large deltidium. The hinge is not well defined and the shell is discinoid in form. * * *

[1] Am. Jour. Sci., 3d series, Vol. XLI, 1891, p. 346; Vol. XLIV, 1892, pp. 150–151.

The external characters as expressed by both valves are manifestly nearer to Kutergina than to any telotremate genus. * * * It should be noted, however, that the young of Chonetes, Productus, Stropheodonta, Orthothetes, Leptæna, Plectambonites, and Strophomena, all have little or no indication of a straight hinge line, and that the extension of this member takes place during later nealogic and ephebolic growth. (Pp. 150–151.)

By far the greatest number of Neotremata occurring in the Lower Cambrian are species of the family Acrotretidæ. To the writer it has always seemed strange to suppose that this family has been derived through the Trematidæ, but the above interpretation of the prodeltidium in Discinisca indicates that the turning of this plate posterior to the pedicle at once led to holoperipheral growth in some of these early forms. In some species of the Acrotretidæ there is a true deltidium. In Acrothele the cardinal area is flat, without any trace of a deltidium, whereas in Acrotreta and Conotreta, which have high cardinal areas, there is a narrow concave depression bisecting it. These deltidia, whether convex or concave, are in all probability initiated by the prodeltidium, as in the Protremata. In the family Trematidæ there appears to be nothing homologous with the deltidium, since the plates situated in the apex of the wide triangular fissure of Schizocrania and Lingulodiscina seem to be formed anterior to the pedicle and subsequent to its movement posteriorly with growth, and not posterior to the pedicle, as in the Acrotretidæ. These plates in the Trematidæ should probably be homologized with the listrium of the Discinidæ.

The complete harmony of the muscular system in the Protremata and Telotremata is no evidence in itself that the latter were derived from the former. The occurrence at the base of the Cambrian of very primitive species of the four brachiopod orders is proof that divergence took place very early in the history of the class, and while there is little knowledge of the muscles in either Iphidea, Kutorgina, or Protorhyncha (*P.? minor and P.? ambigua*), the earliest genera of Atremata, Protremata, and Telotremata, respectively, there is some evidence for supposing them to be as in the type embryo stage of living species. The high degree of specialization attained by Lingula (Atremata), as exemplified by the burrowing habit, long peduncle, and absence of valve articulation, is the cause for their complex muscular system, while the development of a functional hinge in the Protremata and Telotremata has led to the retention of very primitive conditions or to the simplification and harmony of the muscles throughout these two orders.

The presence of a terminal intestinal opening in the living species of the Atremata and Neotremata and its general absence in those of the Protremata and Telotremata is no longer held to have phylogenetic significance, as many of the Paleozoic species of the two latter orders afford good evidence of such having been present in the median line as in living Crania.[1]

[1] See p. 113.

The known protegula, or initial shells, of the Neotremata and Protremata have been shown to be harmonious, and to differ from the normal unmodified protegula of the Atremata and Telotremata. The paterina stage in the two last-named orders is followed by the "obolella stage" in the highest families of the Atremata (Lingulellidæ and Lingulidæ), and probably throughout the Telotremata, since it has been observed in a number of Ordovician and Silurian Rhynchonellacea, Spiriferacea, and recent Terebratulinas.[1] In the Neotremata and Protremata the paterina stage is not followed by the obolella stage, but usually by holoperipheral growth, except where the pedicle slit remains for a time wholly uninclosed by shell matter.[2]

In tabulated form the above-presented facts appear thus:

Table of fundamental brachiopod characters ordinally arranged.

Character.	Atremata.	Telotremata.	Neotremata.	Protremata.
1. Prodeltidium in type embryo.	With dorsal valve.	Absent	With ventral valve.	With ventral valve.
2. Prodeltidium affecting pedicle opening.	None	None	Modified in primitive forms.	Modified throughout.
3. Deltidium present	None	None	Present in primitive forms.	Present throughout.
4. Protegulum	Present	Present	Present	Present.
5. Obolella stage	Present	Present	Absent	Absent.
6. Anus	Present	In many early geologic species.	Present	Present in pentameroids.
7. Chemical nature of shell.	Phosphatic and calcareous.	Calcareous	Phosphatic and calcareous.	Calcareous.
8. Cardinal area	Present, but usually small.	Not generally present.	Present in primitive forms only.	Generally present.
9. Similarity of valves.	Very much alike.	Unlike.	Very unlike.	Unlike.
10. Articulation	Often present, not functional.	Functional	Rarely present, not functional.	Functional.
11. Nature and function of pedicle.	Affixing and burrowing.	Generally present, affixing; shell rarely cemented.	Generally present, affixing; cementation complete.	Affixing or obsolete; cementation or anchoring spines present.
12. Brachia, with or without internal skeleton.	Without	With or without.	Without.	With or without.

It now appears evident that the two great divisions of brachiopods heretofore based on the presence or absence of functional articulation have no phylogenetic significance, and as they "do not appear to have a primary developmental basis in nature, * * * they fail to express the true relationships of the various groups included in them."[3]

[1] See papers by Beecher and Clarke, Brooks, Morse, Beecher and Schuchert, and Winchell and Schuchert.

[2] See Am. Jour. Sci., 3d series, Vol. XLIV, 1891, pp. 150-151.

[3] Beecher, Am. Jour. Sci., 3d series, Vol. XLI, 1891, p. 353; also see Vol. XLIV, 1892.

Articulation was developed along two independent lines, and therefore the terms Lyopomata and Arthropomata have no phylogenetic significance. The presence or absence of articulating processes was at one time considered a fixed line, on either side of which all brachiopods could be arranged, but now articulation is known to be nearly functional in several lyopomatous genera, as in Spondylobolus, Trimerella, Monomorella, Tomasina, Barroisella, of the Atremata, and in Trematobolus of the Neotremata. Among the Arthropomata, articulation is hardly functional in Kutorgina, Schizopholis, Eichwaldia, and Dictyonella. However, it appears probable that two superorders exist, each having two orders. Atremata and Telotremata are the more primitive groups, and agree in the following fundamental characters: Prodeltidium attached to the dorsal valve or absent; pedicle opening primarily unmodified, and generally closed later by calcareous plates secreted by the ventral mantle extensions; presence of a functional pedicle throughout the life of the individual (except in Thecospira, Thecocyr-

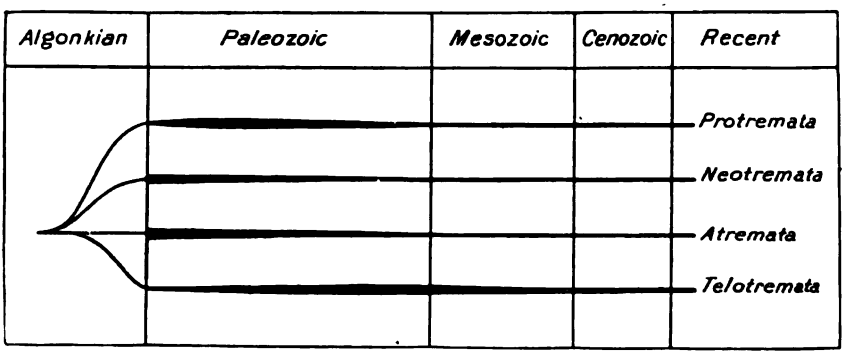

FIG. 1.—Diagram giving the geological distribution of brachiopod orders.

tella, and Bittnerula); general presence of the "obolella stage" in the ontogeny of atremate and telotremate species, and the development of complicated calcareous brachial supports in the derived order. The Neotremata and Protremata agree in having the prodeltidium attached to the ventral valve with complete nepionic modification of the pedicle opening; delthyrium often closed by a single plate secreted by the pedicle and never by mantle extensions; the pedicle is very often lost before maturity is attained, along with the development of new anchoring adaptations; absence of the "obolella stage" and complicated calcarious brachial supports.

Owen's superorders Lyopomata and Arthropomata have no basis in nature, and should be dropped. It is to be hoped that students will determine the complete embryology of Lingula, Discinisca, Crania, Rhynchonella, and Terebratulina, for until more of the ontogeny of some species of these genera is known, no satisfactory relationship which the orders bear to one another can be established. However, it appears probable that Atremata and Telotremata have superordinal relationship

differing from that of the Neotremata and Protremata. If the characters above pointed out are of superordinal value, it will be convenient to refer to these divisions as *Homocaulia* and *Idiocaulia*, respectively.[1]

DEVELOPMENT OF CARDINAL AREAS AND ARTICULATION.

The earliest suggestion of cardinal areas occurs in Iphidea of the Atremata and in the Acrotretidæ of the Neotremata. In none of these forms, however, is there a true cardinal area comparable with those of the Protremata and Telotremata, since it is not bisected by a delthyrium, nor are deltidial plates developed. A convex pseudodeltidium is often present, but this feature is not homologous with the deltidium of the higher forms. It is due to holoperipheral growth and interference by the pedicle. In the dorsal valves of primitive genera in both the Atremata and Neotremata growth is hemiperipheral, but in the ventral valve of Iphidea, the most primitive known genus of Atremata, and in the Acrotretidæ of the Neotremata, growth is holoperipheral.

The ontogeny of many species of Protremata shows that this order had its origin in some atrematous paterina-like genus. This must have occurred in pre-Cambrian times, since in the Lower Cambrian there are several species of Billingsella, a highly developed protrematous genus when compared with the theoretical Paterina. *Kutorgina cingulata* Walcott, also of the Lower Cambrian, is a more primitive species than any Billingsella, and it gives evidence as to the course of evolution from the inarticulate paterina-like ancestor to this rudimentary, articulate, long-hinged genus. *K. cingulata* in connection with the Indian genus Schizopholis Waagen shows that the opening between the widely gaping valves of Paterina, which was entirely occupied by the pedicle, was partially closed by a gradual thickening of the lateral walls, and there was slowly developed a primitive, ventral, cardinal area. This area and the articulating processes in *K. cingulata* are very rudimentary, and are situated at the lateral extremity of the cardinal area; thus this species still retains a very large open delthyrium, much as in the theoretical Paterina. In Schizopholis this wide fissure is reduced to a narrow triangular delthyrium by the development of a true cardinal area, and the articulating processes are now no longer at the lateral extremities, as in Kutorgina, but are situated more medially. Naturally, in the older Cambrian, complete articulation did not obtain, as in post-Cambrian times. Some of the oldest protrematous species, such as *K. cingulata*, *Billingsella whitfieldi*, and possibly others, also retain considerable phosphatic material in their shells, but in later and more highly specialized species the shell is decidedly calcareous.

Some of the species of Iphidea have the ventral posterior region

[1] Ὅμος (homos), ἴδιος (idios), and καυλός (kaulos) = stem or pedicle common to both valves and pedicle restricted to one valve, respectively. These characters may be retained throughout life or restricted to the nepionic and neanic stages of growth.

more drawn out beyond the dorsal posterior margin than others. If this rostrate condition were carried a little farther and the pseudodeltidium resorbed, there would practically result a telotremate shell duplicated by the neanic condition of many rostrate Telotremata. The articulation would at first be nearly obsolete and situated extremely lateral, as in the Protremata, but as the cardinal area became greater the teeth would attain a more medial position. While there are no known genera to fill in the gap between the theoretical Paterina and Protorhyncha (*P. minor and P. ambigua*), yet the hiatus between the Atremata and Telotremata is not greater than between theoretical Paterina and Kutorgina, or between the Atremata and Protremata.

DEVELOPMENT AND SIGNIFICANCE OF THE DELTIDIUM.

The most characteristic mature feature of ordinal importance which distinguishes Protremata from the other three orders is found in the plate that more or less completely covers the delthyrium. However, in two of the families of this order, Pentameridæ and Orthidæ, this plate is generally wanting in the mature individual, since here it usually develops only during early growth, and later is lost by abrasion or hidden beneath the incurved beak. Again, in the Acrotretidæ of the Neotremata, and in Iphidea of the Atremata, a deltidium-like plate is also often developed, but as these shells are strongly phosphatic it is not difficult to distinguish the ordinal position of any shells with a true deltidium. In *Lacazella mediterranea*, the only living species of Protremata, this plate has its origin in the cephalula stage along with the rudiments of the dorsal and ventral valves, when the embryo is yet free and swimming about by the aid of cilia. The dorsal shell and the prodeltidium appear first, and are secreted by the rudimentary dorsal mantle and the dorsal surface of the body, which subsequently becomes the pedicle. The ventral shell appears last, and is then widely separated from the dorsal valve. Between the two valves is the thick and short pedicle, on the dorsal surface of which still remains the third plate, or prodeltidium. Subsequently the latter is anchylosed to the posterior margin of the ventral valve. The prodeltidium is also known in the Atremata and Neotremata, yet in the Telotremata this embryonic third plate does not exist, but a covering to the delthyrium is developed sometime after the animal has become attached. In its origin this covering is wholly different from the deltidium of the Protremata, which has its beginning in the prodeltidium and grows down from the shell apex over the delthyrium, while the deltidial plates of Telotremata grow out medially from the walls of the delthyrium. The deltidial plates are secreted by extensions of the ventral mantle, and at no period of development has the pedicle any share in their formation. It is not always easy to distinguish mature protrematous and telotrematous shells on the basis of these characters alone, but the young of both orders are

easily classified by the covered or open delthyria, respectively. In some of the Telotremata, toward maturity the deltidial plates anchylose medially posterior to the pedicle, or they may surround the pedicle, thus resembling the deltidium, but, since their origin is quite different, they are termed "pseudodeltidia." Such pseudodeltidia in Cyrtia, Cyrtina, and some spirifers resemble the deltidium of Clitambonites. Even the median line of anchylosis is often obliterated by the continuous secretion of the completely united prolongations of the ventral mantle lobe. In the Pentameridæ the deltidium is generally absent, as in the Orthidæ, but in Pentamerus and Conchidium it is often retained as a thin, fragile, concave plate. This reversal in form from the generally prevalent, convex, or flat deltidium may be due to the rostrate and arched ventral umbones so common in these genera. In the aberrant rostrate genus Dictyonella, which has an arched ventral umbone, a concave plate is also present, between which and the shell the pedicle passes and emerges upon the umbone, as in the Siphonotretidæ. It is not certainly known that this plate in Dictyonella is a deltidium, but its form and position in the rostral cavity are very suggestive of that organ in Pentamerus and Conchidium. The peculiar umbonal pedicle opening in Dictyonella also finds its equivalent in Leptæna.

THE CHILIDIUM.

The chilidium is a convex plate often covering the cardinal process of the dorsal valve in the Protremata. It is particularly well developed in the families Clitambonitidæ and Strophomenidæ, and is not to be confounded with the deltidium, since it first makes its appearance not earlier than neanic growth, and apparently is a secretion of the dorsal mantle lobe. The origin of the chilidium and of the deltidium is therefore wholly different, and both have very dissimilar phyletic significance.

ORIGIN AND FUNCTION OF THE SPONDYLIUM.

The spondylium is an internal ventral plate traversing the posterior portion of the animal. The upper surface of this plate is usually transversely marked by striæ, which, in the Pentameracea have three distinct curvatures in passing over it.

Since their position and the area occupied agree with the muscular scars of this valve in *Orthis*, they are here regarded as homologous with the adductors, diductors, and adjustors of that genus. In *Lingulasma*, *Lingulops* and the trimerellids the muscular scars are not found in front nor underneath, but *on* the "platform" of those genera. The platform, therefore, is homologous with the spondylium of *Clitambonites* and *Pentamerus*. * * * The portion of the valve immediately beneath the spondylium, and occasionally the sides of the septum, are strongly marked by the genital sinuses. Since there is no space posterior to these markings for the attachment of the muscles, this clearly indicates that they were situated on the upper surface of the spondylium.[1]

[1] Winchell and Schuchert, Final Rept. Minn. Geol. Survey, Vol. III, Part I, June, 1893, p. 378.

The spondylium is developed as the "platform" in Lingulasmatidæ and Trimerellidæ of the Atremata; as a "spondylium" in Pentameracea of the Protremata, and in Cyrtina, Camerospira, Merista, and Dicamara, of the Telotremata. In the Atremata and Telotremata, spondylia-bearing species are not numerous, but the individuals are usually abundant, often of large size, and generally are of short geologic duration.

The development of the spondylium or its morphologic equivalent probably had its origin in an excessive deposit of testaceous matter about the bases of the powerful adductors, diductors, and pedicle muscles. Growth of the individual necessitates the progressive anterior movement of the muscles, and when these are large there is but little or no space left between or outside of them for the viscera and genitalia, which are therefore crowded farther and farther anteriorly. This condition naturally produces constant pressure of the genitalia against the anterior base of the forming spondylium, and since pressure causes resorption or diverts testaceous deposition, it follows that these organs will gradually produce cavities for their relief beneath this plate. In the older species of the Trimerellidæ and in all of the Lingulasmatidæ displacement of the genitalia does not appear to have been excessive, as the platforms are but slightly excavated. However, in the terminal genus Trimerella the genitalia chambers are very deep, and these are present in both valves. Throughout the Pentameracea the spondylium is a thin, freely terminating or medially supported plate, and never solid as in the older species of the Trimerellidæ. It is likewise thin and excavated in the order Telotremata.

Hall and Clarke advance quite a different explanation as to the origin of the spondylium. They write:[1]

> The *spondylium* is an area of muscular implantation. In its early or incipient condition it is evident that it originates from the convergence and coalescence of the dental lamellæ, and forms a receptacle for the proximal portion of the pedicle, and for the capsular or pedicle muscles. * * * Considering this structure in its incipent condition, where, as in *Orthis*, it is represented only by the convergent dental plates which usually unite with, or rest upon the bottom of the valve, and inclose only the base of the pedicle and its muscles, it will be evident that the plate is actually but a modification of the original pedicle-sheath. It is evidently the inner moiety of this sheath surrounding the pedicle, which has become involved or inclosed by the growth of the pedicle-valve, and further modified by the development of articulating processes where it comes in contact with the brachial valve It therefore follows, as a natural inference, that wherever the spondylium is pres. ent, whether in the incipient condition or in the more advanced stage of development in which it supports all the muscles of the valve, it is, or, at some period of growth, has been accompanied by the *external* portion of the sheath, which is termed the deltidium. Thus the spondylium appears to be but the complement of the deltidium, or the original plate formed upon the body of the embryo, and that portion of the adult shell to which the term deltidium has been applied, is the other part of the original or primitive deltidial plate or pedicle-sheath.

[1] Palæontology of New York, Vol. VIII, Part II, 1895, p. 332.

The writer also previously entertained this view, but when it became known that spondylia are developed where no dental lamellæ exist, as in the Lingulasmatidæ and Trimerellidæ of the Atremata; that spondylia are never present in the Neotremata, where a pedicle-sheath is sometimes well developed, as in the Acrotretidæ; and finally, that a spondylium is even present where no deltidium ever existed, as in the two first-mentioned families, and in Cyrtina, Camerospira, Merista, and Dicamara of the Telotremata, such an explanation became untenable. The fact that solid or excavated spondylia exist in three orders, two of which never developed a pedicle-sheath (Atremata and Telotremata), and one had no dental lamellæ (Atremata), is good evidence that the prodeltidium primarily had nothing to do with the development of spondylia. Further, no spondylia are developed in the Cambrian until long after the deltidium was well established, and therefore the spondylium can not be "but a modification of the original pedicle-sheath." However, it is very probable that when the dental lamellæ in the Protremata became sufficiently wide to join the ventral shell, crowding all the muscles of this valve into a small area, these took advantage of the inner sides of the dental lamellæ for insertion, and thus a continuous layer of testaceous matter was deposited within the rostral cavity. With growth, the muscles move forward and press against the genitalia, which causes resorption or nondeposition for their relief. No spondylia appear before the Upper Cambrian, and here also are the first completely developed dental lamellæ. The so-called Lower Cambrian camarellas have no completely developed dental lamellæ, and are related to the rhynchonelloid genus Protorhyncha, and to *Protorthis billingsi*, which also has no spondylium.[1] Therefore, the further conclusion of Hall and Clarke can not be accepted, that, "where the teeth are wholly without dental lamellæ, or where such lamellæ do not extend to the bottom of the valve, it seems necessary to regard them as instances of degeneracy or resorption of the primitive spondylium."[2]

It seems clear to the writer that since the "shoe-lifter" plate, or spondylium, in Merista and Dicamara is for muscular insertion, this plate in the ventral valve of these genera is the morphic equivalent of the spondylium in the Pentameracea, and that the dorsal muscular plate in Dicamara is the equivalent of the cruralium, and can not "be interpreted as an entirely different structure from the spondylium."[3] It is true that the spondylia of these genera are not exactly like those of the Pentameracea, but since this plate in the Atremata is not formed by the union of dental lamellæ, as these do not exist in this order, there is no reason for rejecting the terminology for these plates in Merista and Dicamara.

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[1] *Camarella minor* and *C. antiqua* are more closely related to Protorhyncha than to any other genus. Of *Orthis billingsi*, the type of Protorthis, very good casts of specimens in the Cornell University Museum are in the National Museum, which show that this genus also has no spondylium, and that its characters are those of Billingsella.

[2] Hall and Clarke, ibid., p. 333.

[3] Ibid., p. 335.

CRURA AND CRURALIUM.

Calcareous processes for the support of the brachia are also developed in the Protremata, in the superfamily Pentameracea, but never to the same degree attained by the Spiriferacea or Terebratulacea of the Telotremata. In the Protremata these supports are first developed in the Syntrophiidæ, and attain their greatest length in the Pentameridæ. Since the two parts often unite medially, forming a plate for muscular insertion either resting upon the valve or supported by a septum, this has been termed a cruralium by Hall and Clarke, to distinguish it from the spondylium of the ventral valve. When the parts remain separate, and are therefore not for muscular insertion, they are homologous with and the equivalent of the crura in the Rhynchonellidæ. The crura of the Pentameracea and Rhynchonellacea arise independently, and are therefore morphologic equivalents.

MORPHOLOGIC EQUIVALENTS.

Because of the presence of similar or identical morphological structures in different groups of mature brachiopods, it is unsafe, on the basis of these alone, to suppose such to have close relationship. The spondylium has been shown to originate independently in three orders: Atremata, Protremata, and Telotremata. Identical mature loops have resulted in different ways in two stocks of the same family, one boreal (Dallinæ) and the other austral (Magellaninæ). Flat and more or less wide cardinal areas develop independently of one another in Protremata and Telotremata (Spiriferacea). Cementation of valves takes place at different and widely separated geologic epochs in Neotremata, Protremata, and Telotremata, and shell plications arise from smooth stocks in Pentameracea, Rhynchonellacea, Spiriferacea, and Terebratulacea. Natural phylogenies can only be established upon ontogenies checked by chronogenesis or geologic succession.

SUMMARY.

In North America there are 1,859 Paleozoic, 49 Mesozoic, and 14 Cenozoic species of fossil Brachiopoda. There are 116 species in the Cambrian, 319 in the Ordovician, 311 in the Silurian, 663 in the Devonian, and 478 in the Carboniferous.

The remarkable scarcity of post-Paleozoic species in America is supposed to be due not so much to the general decline of the class as to great orographic movements during the close of the Paleozoic, which produced complete barriers against the introduction of species from other areas.

Specific differentiation was most rapid in the Ordovician, having exceeded the Cambrian representation more than three times.

Thirty per cent of all American Paleozoic species had wide geographic distribution, which is most pronounced in the Devonian and

Carboniferous systems. One hundred and twenty-one American species are also found on other continents.

Widely dispersed species are least common in the most primitive order, Atremata, and greatest in the highest orders, Protremata and Telotremata. The difference, however, is but 7 per cent.

The order Atremata is represented by 199 species, or over 10 per cent of the American Paleozoic representation. In the Neotremata it is 156, or over 8 per cent. The Protremata have 738 species, or nearly 40 per cent; and the Telotremata 766 species, or about 41 per cent.

The order Atremata is best developed in species and genera in the Cambrian and Ordovician systems; the Neotremata in the Ordovician; the Protremata in the Ordovician, Silurian, and Devonian; and the Telotremata in the Devonian. The climax of differentiation is therefore chronologically related to phylogenetic or sequential origin.

Since the four orders of Brachiopoda are present in the Lower Cambrian, ordinal differentiation must have taken place in pre-Cambrian times. The two more primitive orders, Atremata and Neotremata, have in Lingula and Crania, respectively, genera with longest life histories. This probably is due not so much to their primitive structures as to their modes of living.

The last order to originate, Telotremata, has the greatest number of generic and superfamily characters, and probably also of species.

The last superfamily to appear, Spiriferacea, manifests most rapid evolution and is the second one to die out, being preceded by the Pentameracea. These two superfamilies are the most highly specialized in the orders to which they belong, and their great specialization may be the cause of their early disappearance.

The trunk families of later origin throughout the class manifest the greatest specific and generic differentiation and the widest specific dispersion, and have species of the largest size and often of longer geologic persistence.

The oldest or most primitive families nearly always have short geologic duration (except Rhynchonellidæ) and the least generic and specific differentiation, and commonly the individuals are of small size.

The largest of all brachiopods occur in the families Pentameridæ, Productidæ, and Spiriferidæ, at a time when the class was at the height of differentiation.

Large specific size is probably often gradually attained in genetic lines, and is due to favorable food conditions. The gigantic brachiopods always occur in the later-developed trunk families, and just before their decline in differentiation.

But 8 genera are known to pass from the Paleozoic to the Mesozoic. There are in all 327 brachiopod genera, 227 of which are Paleozoic. The Atremata have 29 genera, the Neotremata 30, the Protremata 89, and the Telotremata 179.

All brachiopods begin with smooth shells and protegula.

The prodeltidium, or third embryonic shell plate, is known in the Atremata, Neotremata, and Protremata. In the Atremata this becomes attached to the dorsal valve, while in the Telotremata it is apparently not developed at all. In the Protremata it becomes attached to the ventral valve, as in Neotremata. In the two last-named orders it modifies the pedicle opening. For this and other ontogentic and morphologic characters, Owen's terms Lyopomata and Arthropomata are abandoned. The Atremata and Telotremata are provisionally arranged under the superordinal term *Homocaulia*, and the Neotremata and Protremata under *Idiocaulia*.

Morphologic equivalents, or similar structural features, are developed independently, as follows: A spondylium in Obolacea, Lingulacea, Pentameracea, and rarely in Spiriferacea; crural processes in Pentameracea and Rhynchonellacea; functional articulation in Protremata and Telotremata; straight, more or less long, cardinal areas from rostrate forms in Rhynchonellacea, Spiriferacea, and Terebratulacea; rostrate shells from long cardinal areas in Pentameracea, and loss of pedicle and ventral shell cementation in Craniacea, Strophomenacea, and Spiriferacea.

CHAPTER IV.

MORPHOLOGY OF THE BRACHIA.

By CHARLES E. BEECHER.[1]

The diagnostic value of the brachidium, or calcareous arm supports, of brachiopods has long been recognized, and forms one of the chief characters for generic and family subdivision among the Terebratulacea and Spiriferacea. This character fails in all other brachiopods, which have simply fleshy arms, unsupported by calcareous skeletons. There is, however, generally the most obvious analogy and intimate relationship between the arms themselves and the brachidium, so that whenever either structure can be ascertained it furnishes important data aiding in the determination of the systematic position of any genus within a family or order.

The growth of the arms, or lophophore, in recent genera may be divided into distinct stages, which often have a direct correlation with other important features of the shell. In many cases it is also possible to infer the form and arrangement of the brachia in fossil genera from markings on the interior of the valves and from the calcareous arm supports, and thus to obtain the chronogenetic as well as the morphogenetic history of these organs.

The most detailed accounts of arm development are given by Brooks[5] for Glottidia, by Morse[11] for Terebratulina, and by Kovalevski[10] for Cistella and Thecidea. These results, combined with original observations by the writer[1,2] and occasional descriptions of arm structure by Davidson[7] and other authors, are sufficient to include and properly interpret all the leading varieties of structure.

As shown by Brooks,[5] the tentacles, or cirri, in Glottidia originate on the dorsal side of the oral disk. They grow in pairs, one on each side of a central lobe. New tentacles are added between the first pair formed and the median lobe. Thus the cirri farthest removed from the median lobe are the oldest. Tentacles are added rapidly until the first arc is extended to a semicircle, and then progressively the whole disk becomes surrounded by a circle of these organs. The further introduction of cirri can only take place by the enlargement of the oral disk or through the deformation of the circle by lobes, loops, or extensions. In Glottidia, Lingula, Discinisca, Crania, and Rhynchonella the two points of tentacular increase, originally together and on

[1] The references to the literature will be found at the end of this chapter.

opposite sides of a median lobe, or tentacle, gradually separate, and the further multiplication of tentacles results in strap-shaped extensions on each side, which finally assume a coiled form, due to the limited space in which they grow. Therefore the arms in adult individuals of these genera have a single cirrated edge, extending from their free extremities to the sides of the oral disk, and, continuing posteriorly, unite on the ventral side of the disk behind the mouth. Each cirrated edge in the adult lophophore apparently has two approximate rows of alternating cirri (Hancock[9]), but as they were originally a single row in early stages, this appearance is evidently the result of a crowding of the cirri or a crumpling of the edge.

Kovalevski[10] has shown that in Cistella the tentacles also originate in pairs on each side of the dorso-median line, without a central tentacle or lobe. The same mode of increase has been shown by the writer[2] to be present in Magellania and Terebratalia. In young stages of Cistella, Terebratulina, Magellania, and other terebratuloid genera, as well as in Thecidea, after the circlet of tentacles is complete the two points at which new ones are added do not separate, but remain close together throughout the life of the animal. In this case the cirrated margin is lengthened by means of lobation and looping, and often by the final growth of a single, median, coiled arm, cirrated on both margins. Gwynia illustrates the completed circle of tentacles about the mouth. Adult Cistella shows an advance in having the anterior margin of the lophophore introverted, making it bilobed. Megathyris is slightly more complicated by two additional lobes. This simple method of increase is further elaborated in the Thecidiidæ. In the higher genera, especially among the Terebratulidæ, the maximum is reached by means of a median, unpaired, coiled arm, as in Magellania and Terebratulina.

The development of the different types and varieties of arm structure is presented in the accompanying figures (figs. 2–6), which are necessarily somewhat diagrammatic in order to show the features clearly, but the essential structure can readily be verified from consultation of the works cited or from a study of actual specimens. In the case of fossil forms, such as Dielasma, the Atrypidæ, and Athyridæ, the brachial supports have sufficient analogy with the arm structures of Terebratulina and Rhynchonella to warrant their interpretation as given. Also the spiral impressions on the valves of Davidsonia, and those occasionally present in Leptæna and Productus, clearly point to the possession of coiled arms by these genera.

CLASSIFICATION OF BRACHIAL STRUCTURES.

From what has already been shown it is seen that the various types of lophophores admit of a simple classification into stages and groups. It is proposed to give to these distinctive names, which may be used with facility in making comparisons and correlations. They may be found

useful, also, in designating the kind of brachial complexity attained in any genus the arm structure of which can be determined, thus helping to fix its place in a genetic scale. It should be emphasized, however, that the form and complexity of the cirrated margin of the lophophore can have a taxonomic value only within comparatively narrow limits. This at once becomes evident when the arms of Lingula, Discinisca, Crania, Rhynchonella, and all the Spiriferacea are considered. Each has spiral arms, which were probably developed through similar changes of form, and yet each is genetically distinct, as shown by all the other leading characters. But when this classification of arm structures is applied within a family or genus, or even when made the basis of comparison among some closely related families, it is sometimes possible to reach very satisfactory conclusions relating to the systematic position of various forms.

LEIOLOPHUS STAGE.

It is hardly necessary to direct attention to the embryonic brachial structure before the growth of any of the tentacles, or cirri, on the edge of the lophophore, while the animal is in the typembryonic stage. For the sake of designating all the stages, this may be called the *leiolophus* stage, though it has no special significance beyond indicating the beginning of the lophophore.

TAXOLOPHUS STAGE.

The first stage in which a true brachial structure is manifest is an early larval form, often the protegulum stage, when the tentacular portion of the lophophore is a simple arc, or crescent. This may be called the *taxolophus*. The tentacles are few in number, and increase takes place on each side of the median line, dorsally, in front of the mouth. In figs. 2*a*, *e*, 3*a*, *f*, 5*a* this character is clearly shown. The tentacles at the ends of the arc are the oldest, and new ones are being formed in the middle portion. In Thecidea, Cistella, and Magellania the tentacles of the taxolophus are centripetal, due to the edge of the lophophore being near the margin of the shell; while in Terebratulina, Discinisca, and Lingula they are centrifugal, due to the smaller and central lophophore.

So far as known, there is no adult living form which has the taxolophian brachial structure. It may have been present in adult Iphidea of the Cambrian.

TROCHOLOPHUS STAGE.

By the continual addition of new cirri and the pushing back of the old ones, the fringed margin of the lophophore passes from a crescentic to a circular form, thus making a complete ring about the mouth. This may be termed the *trocholophus* stage. It appears in the late larval and early adolescent stages of Thecidea (fig. 2*b*), Cistella (fig. 2*f*), Magellania and Terebratalia (fig. 3*b*), Terebratulina (fig. 3*g*), Glottidia (fig. 5*b*),

and Discinisca, and, like the former stages, is undoubtedly common to all brachiopods, except, perhaps, Iphidea.

Gwynia is an adult living representative of this stage, and never develops any higher type of brachial structure. Dyscolia also belongs here, since it has a discoid lophophore surrounded by a marginal fringe of tentacles (Fischer and Œhlert[8]). It is possibly a little more advanced than Gwynia, as it has a slight median anterior notch, suggesting the beginning of the bilobed structure of the next higher type.

The absence of septum, hinge-plate, and dental plates are other primitive characters belonging to Dyscolia.

SCHIZOLOPHUS STAGE.

After the completion of the trocholophus stage in all brachiopods, except such simple forms as Gwynia and Discolia, no further increase in the cirrated edge of the lophophore can occur without some deformation of the circle. This is first accomplished by an introversion of the anterior median edge, thus dividing the lophophore into two lobes, and suggesting the name *schizolophus* for this type. (See figs. 2*c*, *g*, 3*c*, *h*, 5*c*.)

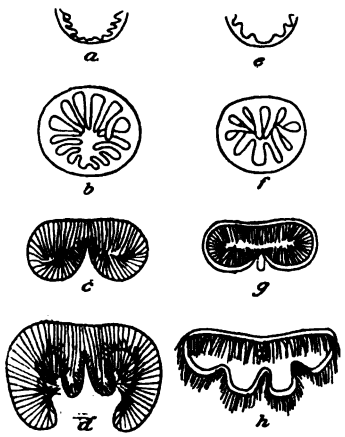

FIG. 2.—Stages of growth of the lophophore in Thecidea, Cistella, and Megathyris. *a*, *b*, *c*, *d*, stages in the growth of the lophophore in *Thecidea* (*Lacazella*) *mediterranea*, enl. (*a*–*c* after Kovalevski, *d*, after Lacaze-Duthiers). *e*, *f*, early stages of lophophore of *Cistella neapolitana*, enl. (after Kovalevski). *g*, adult lophophore of Cistella (*C. cistellula*), enl. (after Davidson). *h*, labial appendages of *Megathyris decollata*, enl. (after Davidson).

Several brachiopods retain the schizolophian brachia as an adult character. Of these, Cistella is perhaps the best example, as it agrees exactly with an early stage of arm structure among the Terebratellidæ, which has been called the cistelliform stage (fig. 3*c*). Terebratulina (fig. 3*h*), Glottidia (fig. 5*c*), and other higher forms, also have corresponding schizolophian stages, but are without the median septum. *Lacazella mediterranea* presents a similar larval structure, and in *L. barretti* it is retained to maturity. The fossil genera Davidsonella and Thecidella of the Thecidiidæ, and Zellania of the Terebratellidæ, never developed beyond the schizolophus stage, and they must therefore be considered as quite primitive genera in their respective families.

From this point the further development and complication of arm structure proceeds in three distinct diverging lines, producing the

three characteristic types of brachia of all the higher brachiopods, as exemplified in Thecidea, Terebratulina, and Rhynchonella.

PTYCHOLOPHUS STAGE.

The simplest of the types of brachia just cited is developed out of the schizolophus by the additional lobation, or looping, of the primary lobes, making a structure which may be called the *ptycholophus*. Megathyris and *Lacazella mediterranea* both have 4 lobes (fig. 2*d*, *h*); *Thecidea radiata* has 6; *T. vermicularis* and *Eudesella mayale*, 8; *E. digitata*, 10; Pterophloios and Oldhamina, about 20. Lobation in some (Thecidea) is produced by the forking or branching of the median septum; in others (Pterophloios) the septum remains simple while the lateral borders of the lophophore are lobed.

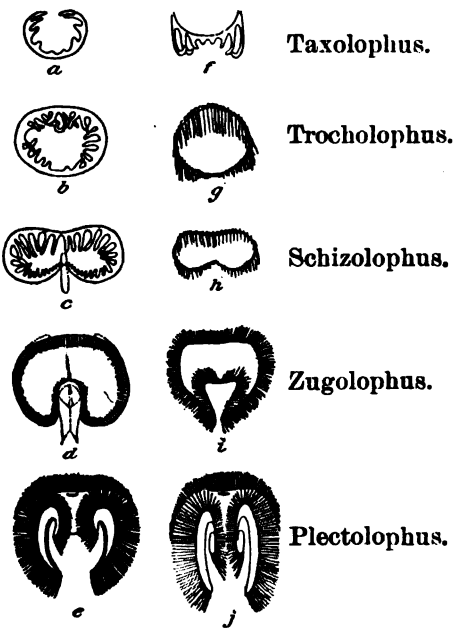

FIG. 3.—Stages of growth of the lophophore in the Terebratellidæ and Terebratulidæ. *a*, *b*, *c*, *d*, *e*, five stages in the development of the lophophore in the Terebratellidæ. *a–d*, *Terebratalia obsoleta*, enl. (after Beecher[2]). *e*, *Magellania kerguelenensis*, nat. size (after Davidson[7]). *f*, *g*, *h*, *i*, *j*, development of lophophore in the Terebratulidæ. *f–i*, early stages in *Terebratulina septentrionalis*, enl. (after Morse[11]). *j*, adult *Terebratulina cancellata* (after Davidson[7]).

ZUGOLOPHUS AND PLECTOLOPHUS STAGES.

All the higher Terebratulacea reach the final growth of the lophophore through an intermediate stage which from its form may be called the *Zugolophus*—fig. 3*d*, *i*. Eucalathis and Platidia (?Tropidoleptus) are apparently adult representatives of this stage, while Kraussina and probably Bouchardia are slightly more advanced by the growth of a short median, coiled arm, and lead to the next highest, or plectolophus, stage, in which there is a well-developed spiral arm with a fringe of cirri on each edge—fig. 3*e*, *j*.

A long loop pointed in front like Rensselæria and Centronella could not have supported a median arm, as the pallial cavity is thus fully occupied, and the development of the brachidium in the Terebratellidæ shows that the central space between the branches of the loop is to accommodate such an organ. The same is doubtless true of Dielasma, which first has a Centronella-like loop, and through the subsequent resorption of the anterior portion the ascending branches are formed

and space allowed for the median arm—fig. 4*a–d*. In a spire-bea genus like Zygospira this is more obvious, for here the transverse cessor jugum is c ly the result of growth and re tion of the centr liform loop to a the spiralia.

FIG. 4.—Metamorphoses of the brachidium in *Dielasma turgida*, enl. (after Beecher and Schuchert).

The calcareous loop in Terebratulina and Liothyrina is only a post basal support, and does not repeat the outline of the cirrated marg the lophophore, exclusive of the arm. Therefore it is impossibl these and closely allied genera to infer the stage of development o lophophore from the loop alone. Dyscolia is an excellent example, the loop is the same as in Terebratulina; but the lophophores are quite distinct in each, the former being of the trocholophus type and the latter belonging to the plectolophus.

SPIROLOPHUS STAGE.

The last type to be noticed is the one in which there are two separate coiled arms, each with a row of cirri on one edge only—fig. 5*d*, *e*. It embraces the greater part of the families of brachiopods in the orders Telotremata and Protremata, and includes all the living species in the orders Atremata and Neotremata.

In the early stages of development of the spiral lophophore there is an agreement with the early stages of the families already noticed, and the taxolophus, trocholophus, and schizolophus stages may be determined—fig. 5*a*, *b*, *c*. The separation and growth of the spiral arms seem to be due to the widening or expansion of the median lobe or tentacle, on each side of which is the formative tissue for new cirri. This is very apparent in the young Discinisca described by Muller,[12] and the Glottidia described by Brooks.[5]

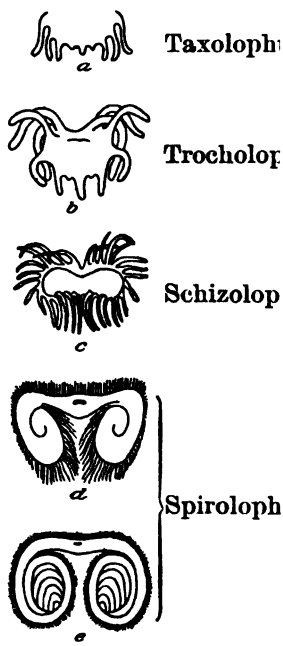

FIG. 5.—Early stages of lophopl Glottidia and adult brachia in L and Hemithyris. *a*, *b*, *c*, early st lophophore of *Glottidia audebar* (after Brooks). *d*, adult brachia i gula (after Woodward). *e*, adult b in *Hemithyris psittacea* (after Han

The brachidium in Zygospira passes through a series of cha which have been described in detail elsewhere.[4] These metamorph are of great assistance in understanding the development and parative morphology of this feature in other groups of the Spirifer The earliest stage observed (fig. 6*a*) has the form of a simple tereb loid loop, which, from its resemblance to Centronella, was called

centronelliform stage. Since approximately this form of brachidium is also characteristic of the young of recent terebraluloids, it may be taken in Zygospira as indicative of the trocholophus stage of brachial development. With this as a starting point for comparison, the further correlation of the succeeding stages is very simple.

The first resorption of the end of the loop in Zygospira produced a schizolophus condition, and further resorption carried the brachidium to a stage closely resembling Dielasma (fig. 6*b*). The dielasmatiform stage has already been explained as due to the requirements of space for the growth of the coiled brachia. Next, the initial calcification of the spiral arms resulted in the extension of the descending branches beyond the jugum (fig. 6*c*), and, lastly, complete calcification manifests the spirolophus structure and produced the characteristic brachidium of the Spiriferacea.

The Atrypidæ and the Athyridæ seem to stand to each other in the same relation as the Terebratellidæ and Terebratulidæ. In the first the descending branches are widely separated and follow the edges of the valves; in the second the descending branches are close together. This difference in the Spiriferacea produces the converging cones of the Atrypidæ (fig. 6*d*) and the diverging cones of the Athyridæ, Spiriferidæ, Retziidæ (fig. 6*e*), etc.

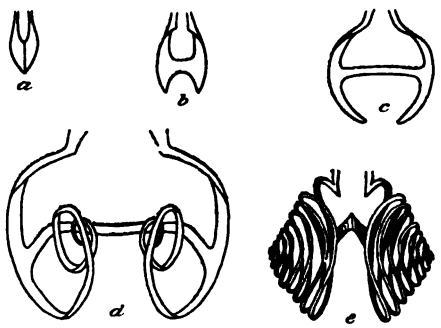

FIG. 6.—Metamorphoses of brachidium of Zygospira and adult brachidium of Rhynchospira. *a*, *b*, *c*, *d*, metamorphoses of brachidium of *Zygospira recurvirostra*, enl. (after Beecher and Schuchert). *e*, Brachidium of *Rhynchospira evax* (after Beecher and Clarke).

It seems doubtful whether the fleshy portions of the brachia in the Meristellidæ and Athyridæ possessed additional characters expressing the complexity and elaboration reached by the jugal processes, even when the lamellæ were duplicated, as in Koninckina and Kayseria.

From the above descriptions and illustrations it appears that the mode of growth of the cirrated lophophore, or brachia, is alike in the larval stages of all brachiopods. They first develop tentacles in pairs on each side of the median line in front of the mouth (taxolophus stage). New tentacles are continually added at the same points, until, by pushing back the older ones, they form a complete circle about the mouth (trocholophus stage), later becoming introverted in front (schizolophus stage). From this common and simple structure all the higher types of brachial complication are developed through one of two methods: (1) The growing points of the lophophore, or points at which new tentacles are formed, remain in juxtaposition; or (2) they separate. Complexity in the first is produced (*a*) by lobation, as in

Megathyris, Eudesella, Pterophloios, Thecidea, etc. (ptycholophus type) and (*b*) by looping (zugolophus) and the growth of a median, unpaired coiled arm (plectolophus), as in Magellania, Terebratulina, etc.; in th second (*c*) by the growth of two, separate, coiled extensions or arms one on each side of the median line (spirolophus), as in Lingula Crania, Discinisca, Rhynchonella, Leptæna, Davidsonia, Spirifer, Athy ris, Atrypa, etc.

REFERENCES.

1. Beecher, C. E., 1893: Revision of the families of loop-bearing Brachiopod Trans. Conn. Acad., Vol. IX.

2. Beecher, C. E., 1893: The development of *Terebratalia obsoleta* Dall. Tran Conn. Acad., Vol. IX.

3. Beecher, C. E., and J. M. Clarke, 1889: The development of some Siluria Brachiopoda. Mem. N. Y. State Museum, Vol. I, No. 1.

4. Beecher, C. E., and Charles Schuchert, 1893: Development of the brachial su ports in Dielasma and Zygospira. Proc. Biological Soc. Washington, Vol. VIII.

5. Brooks, W. K., 1879: The development of Lingula and the systematic positio of the Brachiopoda. Johns Hopkins Univ., Chesapeake Zool. Lab.

6. Davidson, T., 1851–1885: A monograph of the British fossil Brachiopoda. Pal. So

7. Davidson, T., 1886–1888: A monograph of recent Brachiopoda. Trans. Lin Soc., London, Vol. IV.

8. Fischer P., and D.-P. Œhlert, 1892: Résultats des campagnes scientifiqu accomplies sur son yacht par Albert 1re, Prince Souverain de Monaco. Fs. II Brachiopodes de l'Atlantique Nord.

9. Hancock, A., 1858: On the organization of the Brachiopoda. Phil. Trans Vol. CXLVIII.

10. Kovalevski, A. O., 1874: Observations on the development of Brachiopod Proc. Imp. Soc. Amateur Naturalists, etc., held at the University of Moscow, 11t year, Vol. XIV.

11. Morse, E. S., 1873: On the early stages of *Terebratulina septentrionalis* (Co thouy). Mem. Boston Soc. Nat. Hist., Vol. II.

12. Müller, F., 1860: Beschreibung einer Brachiopodenlarve. Archiv Ana Physiol., Jahrg. 1860.

CHAPTER V.

CLASSIFICATION OF THE BRACHIOPODA.

HISTORICAL.

Fabius Columna, in 1616, and Martin Lister, in 1678, were the first to describe brachiopods, calling them *Conchæ anomiæ*. Grundler, in 1774, was, however, the first to give a good illustration of a brachiopod in *Terebratulina caput-serpentis*. In 1818 Lamarck recognized 5 genera, including the operculate coral Calceola. Other genera were added by Sowerby, Dalman, and Defrance, from 1820 to 1830, and in the early forties about 1,500 species had been defined. In 1849 King recognized 49 genera in 16 families, and Bronn, in 1862, knew nearly 2,000 species and 51 genera. At present there are probably no fewer than 6,000 species known in 321 genera, grouped in 31 families, 9 superfamiles, 4 orders, and 2 superorders.

Since 1858 the class Brachiopoda has been divided by nearly all systematists into two orders, based on the presence or absence of articulating processes. These two divisions were recognized by Deshayes as early as 1835, but not until twenty-three years later were the names Lyopomata and Arthropomata given to them by Owen. These terms have been generally adopted by authors, though some prefer Inarticulata and Articulata of Huxley, or Bronn's Ecardines and Testicardines. Bronn, in 1862, and King, in 1873, while retaining these divisions, considered the presence or absence of an anal opening more important than articulation, and accordingly proposed the terms Pleuropygia and Apygia, and Trententerata and Clistenterata, respectively. In many Paleozoic genera of Clistenterata it has been shown that an anal opening was also present, and therefore the absence or presence of this organ is not of superordinal value. Beecher writes:[1]

> The dorsal beaks of Amphigenia, Athyris, Cleiothyris, Atrypa, and Rhynchonella are usually notched or perforate. The perforation comes from the union of the crural plates above the floor of the beak leaving a passage through to the apex. A similar opening occurs between the cardinal processes in Strophomena, Stropheodonta, and allied genera, and the chilidium may also be furrowed, as in *Leptæna rhomboidalis*. This character is evidently in no way connected with the pedicle opening, but points to the existence, in the early articulate genera, of an anal opening dorsal to the axial line, as in the recent Crania. This dorsal foramen was described and figured by King

[1] Am. Jour. Sci., 3d series, Vol. XLIV, 1892, p. 147. See also King, A Monograph of the Permian Fossils of England, 1850; and Œhlert, Fischer's Manuel de Conchyliologie, Appendice, 1887.

in 1850, Hall in 1860, and by several authors since, and has commonly been termed a visceral foramen. Œhlert suggests that it was probably occupied by the terminal portion of the intestine. The persistence of the foramen seems to indicate an anal opening.

Hall and Clarke state:[1]

It has become evident, from a study of the hinge plate, that the so-called visceral foramen which perforates it, and which is often present in Athyris, Rensselæria, Cryptonella, etc., is a remnant of this aperture, the remainder of the median opening having become filled by a testaceous secretion. There is every reason to believe that the visceral foramen was actually traversed by the lower alimentary canal, and if this were true, then the deep and narrow median chamber bounded by the crural plates must also have inclosed the terminal portion of the intestine.

In 1834 Von Buch also divided the class into two sections, founded on the mode of attachment. The first section contained all brachiopods fixed by a pedicle to foreign bodies, while the second was restricted to those forms in which there is no pedicle at maturity, the entire lower or ventral valve being cemented to other objects, as in Crania. The first section was again divided into three groups, on the basis of the pedicle: (*a*) Pedicle emerging from between the valves, as in Lingula; (*b*) ventral valve perforated for the protrusion of the pedicle; and (*c*) uncemented shells without a pedicle opening. The third group, however, is identical with *b*, since Leptæna, Productus, and Strophomena, genera referred to section *c*, do possess a pedicle opening. While this classification lacks a complete understanding of the features in question, it is remarkable that Von Buch nearly sixty years ago, and Deslongchamps twenty-eight years later, recognized some of the principles upon which the classification of the Brachiopoda is now established, viz, the nature of the pedicle opening.

Up to 1846 the general external features of brachiopods served the majority of authors as the essential basis for generic differentiation. In that year, however, King pointed out that more fundamental and constant characters exist in the interior of the shell, a fact which soon came to be generally recognized, mainly through the voluminous writings of Thomas Davidson.

In 1848 Gray, probably stimulated by King's paper, divided the Brachiopoda into two subclasses, Ancylopoda and Helictopoda. These divisions rest entirely on the basis of the structure and the presence or absence of calcareous supports. The Ancylopoda are distinguished in having the "oral arms recurved and affixed to fixed appendages on the disk of the ventral [dorsal] valve," while in Helictopoda "they are regularly spirally twisted when at rest." The brachia, however, in all recent species, are recurved and more or less spirally enrolled, except in some gerontic forms of loop-bearing genera, as Cistella and Gwynia. Therefore Helictopoda, as far as the brachial structure is concerned, will also include the Ancylopoda. In fact, to the former Gray referred only the terebratuloids, if Thecidia is

[1] Palæontology of New York, Vol. VIII, Part II, 1895, p. 334.

excluded, while the Ancylopoda contained all other brachiopods, both articulate and inarticulate forms. These subclasses are further divided, on the basis of the brachia, into four orders: Ancylobrachia, Cryptobrachia, Sclerobrachia, and Sarcicobrachia. Of these the first only has value as a superfamily, since it includes the "loop-bearing" genera, or Terebratulacea. The other orders have so heterogeneous an assemblage of forms as to be of no permanent value.

Beyond the introduction of new families, no further attempt was made by writers to divide the Brachiopoda into other orders than Lyopomata and Arthropomata until 1883, when Waagen published his great work on the fossils of this class from the Salt Range group of India. He found it "absolutely necessary" to further divide the Lyopomata and Arthropomata into seven suborders. The basis for these suborders has no underlying principle of general application, yet the majority of the divisions are of permanent value, for each contains an assemblage of characters not to be found in any of the others. Waagen's genealogy of the Arthropomata, with Orthis as the prototype, falls at once to the ground, since the comprehensive studies of the genus Orthis by Hall and Clarke have shown that it is questionable "whether any of these primordial forms can be included under Orthis according to the strict definition of the term or even under any of the subdivisions"[1] proposed by them. There are, however, a few species in the Upper Cambrian which seem to agree with such dalmanellas as *O. subæquata*, but these originated long after many undoubted Protremata and Telotremata had lived in the Lower and Middle Cambrian. Lingula, on the other hand, was usually regarded as the prototype of all brachiopods, but this is also impossible, since a number of inarticulate genera flourished for ages before Lingula was developed.

PRINCIPLES OF CLASSIFICATION.

No classification can be natural and permanent unless based on the history of the class (chronogenesis) and the ontogeny of the individual. However, as long as the structure of the early Paleozoic genera of Brachiopoda remained practically unknown and the ontogeny untouched, nothing of a permanent nature could be attempted. In the recent volumes by Hall and Clarke many of these early genera are clearly defined, so that their structures and geologic sequence are now far more accurately known. The ontogenetic study of Paleozoic species was initiated in 1891 by Beecher and Clarke, and was continued by Beecher and Schuchert. These results, combined with those derived from the development of some recent species, and published by Kovalevsky, Morse, Shipley, Brooks, Beecher, and others, confirm the conclusions reached through chronogenesis. Moreover, the application by Beecher of the law of morphogenesis, as defined by Hyatt, and the

[1] Palæontology of New York, Vol. VIII, Part I, 1892, p. 218.

recognition and establishment of certain primary characters have resulted in the discovery of a fundamental structure of general application for the classification of these organisms. It has for its basis the nature of the pedicle opening and the stages of shell growth. On these characters Beecher has divided the class into four orders—the Atremata, Neotremata, Protremata, and Telotremata.[1]

Hall and Clarke[2] reject Beecher's ordinal terms Atremata and Neotremata for the subordinal names Mesokaulia and Daikaulia of Waagen, on the ground of priority, and because the latter terms are "an admirable expression of the significance of the pedicle passage." If some of Waagen's subordinal terms are elevated to ordinal rank and amended by Hall and Clarke, then these terms are no longer Waagen's, but should be credited to Hall and Clarke. Such being the case, the law of priority demands the retention of Beecher's terms, as they do not conflict with those of Waagen but with the secondary definition and rank accorded them by Hall and Clarke.

On the other hand, Dall claims[3] that "names of higher rank than genera are not subject to the rule of strict priority, on account of the mutability of their limits." Again, if Waagen's subordinal terms (and there are seven of them) are to be elevated to ordinal rank—i. e., if the characters upon which they are established are ordinal characters—then all should be elevated alike in rank. Besides the two mentioned above, Hall and Clarke accept also Gasteropegmata and Helicopegmata. The latter, however, they retain as suborders, and would do likewise with Kampylopegmata if Gray's term Ancylobrachia of earlier date did not cover the same group of brachiopods; while Gasteropegmata, having certainly no greater value than a superfamily, is elevated to an order. Again, they accept Beecher's Protremata, when Waagen's suborder Aphaneropegmata could as well be raised to ordinal rank and adapted so as to include the former, since Waagen based the latter upon families having the diagnostic character of the Protremata, namely, the well-developed deltidium. However, a far more important reason why Waagen's terms should not be elevated to ordinal rank and made to displace Beecher's names is that the latter clearly understood the value of the different ordinal characters and defined them excellently, which definitions are accepted by Hall and Clarke. He pointed out the most primitive shelled condition in the protegulum, and found this first shell-growth stage in all the important families in the class. He observed that not the mere pedicle slit of the Daikaulia is the ordinal character for Neotremata, but the way in which growth proceeds to form this derived pedicle slit from the open pedicle notch of primitive forms. He was the first to interpret the true morphologic

[1] Development of the Brachipoda, Part I, Am. Jour. Sci., 3d series, Vol. XLI, 1891; Part II, ibid., Vol. XLIV, 1892.

[2] Palæontology of New York, Vol. VIII, Part II, summary, 1895.

[3] Trans. Wagner Free Institute of Science, Phila., Vol. III, Part III, 1895, p. 565, Rule XII.

meaning of the deltidium and deltidial plates, and subsequently, from the works of others, chiefly Kovalevsky, was able to demonstrate the great morphologic significance of the deltidium. Without any injustice to the monumental work of Waagen—and there is no more careful work on the Brachiopoda—it can safely be asked, Were Waagen's suborders based on a fundamental morphologic character of general importance throughout or on ontogeny? Mesokaulia and Daikaulia are the only two of the seven suborders having, as now understood, the required ordinal characters, and these divisions were established by Waagen on the form, general expression, and the position of the pedicle, and not on the morphologic development of the pedicle opening. Four of the other five suborders are based on superfamily and the fifth on family characters. Five of Waagen's seven suborders, therefore, are here retained as superfamilies, and practically in the sense of their author.

Since orders are established on the nature of the pedicle opening, persistent internal characters of the shell are, as a rule, used for superfamily purposes. Such are the absence or presence of a spondylium (Strophomenacea and Pentameracea, respectively); the absence or presence of calcareous brachial supports, and their nature (crura only in the Rhynchonellacea, loop in the Terebratulacea, and spirals in the Spiriferacea).

Families within the superfamilies are based upon a combination of external and internal generic characters common to many genera, or even to one genus. Such characters are: Outer form; nature and position of muscles (Obolidæ, Lingulidæ, etc.); internal plates (Trimerellidæ, Lingulasmatidæ, Pentameridæ); peculiarities of the cardinal process (Orthidæ, Strophomenidæ); imperfection or perfection or persistent peculiarities of ordinal and superfamily characters (Orthidæ, Trematidæ, Discinidæ, Siphonotretidæ, etc.); simplicity or complexity of the jugum (Hindellinæ, Diplospirinæ, etc.); and occasionally the nature of the shell structure (Rhynchospirinæ). When families are large it is not rare to find groups of genera having a common origin which have characters in common but not differentiated sufficiently to introduce new characters of family importance. In such cases it is advisable to divide the family into subfamilies, which facilitates systematic review and discussion. Such is the case in the large families Strophomenidæ, Terebratulidæ, Terebratellidæ, Spiriferidæ, and Athyridæ.

No division, however, has any value unless the group contains forms of but one phylum. A phylum, or line of descent, can not originate twice. It happens, however, that the same or nearly the same combination of mature characters is developed along different phyla. When this occurs the ontogeny will show it. It is therefore not correct to group these different stocks as belonging to one family. For instance,

the Trimerellidæ and Lingulasmatidæ have family structures in common and were referred to the same family. Ontogeny and chronogenesis, however, show that the former family originated directly in the Obolidæ, while the latter was not evolved from the linguloid phylum until the Obolidæ had given origin to the Lingulellidæ and the Lingulidæ. Again, the family Terebratellidæ, probably during early Mesozoic times, divided, one stock drifting into boreal and another into austral regions. These two stocks agree in the earliest shelled condition and at maturity, but between these two stages of growth the austral group (Magellaninæ) passes through a series of loop metamorphoses different from that through which the boreal group (Dallinæ) passes. Therefore it is unnatural to include both in one subfamily, as was formerly done.

It was by the application of the above-mentioned principles that the writer, in 1893, arranged all brachiopod genera under the four orders instituted by Beecher. Since then this subject has received considerable attention, and the many Cambrian brachiopods brought together by Walcott have been examined as to their generic structures. These studies have led to some changes in the classification which follows, the most important being that the order Telotremata could not have originated in the Pentameriidæ, since no Pentameracea are known in the Cambrian until long after that order had representation. The divisions Lyopomata and Arthropomata, introduced by Deshayes and Owen, have been abandoned for reasons given in previous pages.

CLASSIFICATION AND SYNONYMY.[1]

Class BRACHIOPODA Cuvier, 1802; Duméril, 1

Spirobranchiophora Gray, 1821; Palliobranchiata Blainville, 1824; Branchiopoda Risso, 1826 (not Latreille); Brachiopodidæ Broderip, 1839; Branchionopoda Agassiz, 1847; Brachionocephala Bronn, 1862; Spirobranchia Bronn, 1862; Branchionobranchia Paetel, 1875.

Bivalved Molluscoidea with inequivalved, equilateral shells attached to extraneous objects by a posterior prolongation of the body, or pedicle, (1) throughout, (2) during a portion of life, or (3) cemented ventrally. Valves ventral and dorsal. In composition, phosphatic or calcareous, or both. Animal consisting of two pallial membranes intimately related to the shell. Within the mantle cavity at the sides of the mouth are inserted the two, more or less long, oral, usually spirally enrolled, cirrated brachia, which are variously modified, and are supported in the two terminal superfamilies by an internal calcareous skeleton, or brachidium, attached to the dorsal valve. Anus present or absent. Central nervous system consisting of an œsophageal ring, with weakly

[1] All names in small type and indented are synonyms of the term in larger type immediately preceding.

developed brain and infraœsophageal ganglionic swellings. Blood-vascular system probably present, with the sinuses developed into vascular dilatations at the back of the stomach and elsewhere. Sexes separate. Exclusively inhabitants of the sea. The class is present in the Lower Cambrian, attained maximum development in the Silurian and Devonian, and is represented by about 140 living species. During this time, probably upward of 6,000 fossil and recent species have been developed, and these are distributed in 328 genera, grouped in 31 families, 10 superfamilies, and 4 orders.

Order **ATREMATA** Beecher, 1891.[1]

Mesokaulia, or Lingulacea (partim) Waagen, 1885.

Inarticulate Brachiopoda with the pedicle emerging freely between the two valves, the opening being more or less shared by both. Growth taking place mainly around the anterior and lateral margins, never inclosing or surrounding the pedicle. Aperture unmodified. Prodeltidium attached to dorsal valve.

Superfamily **OBOLACEA** Schuchert, 1896.[2]

Rounded or semicircular and more or less lens-shaped, thick-shelled, primitive Atremata, fixed by a short pedicle throughout life to extraneous objects.

1.[3] Family PATERINIDÆ Schuchert, 1893 (emend.).[4]

Obolacea with the dorsal valve semicircular and the ventral subcircular in outline. Posterior region more or less closed by cardinal areas.

Iphidea Billings, 1872.
Paterina Beecher, 1891.

Volborthia von Möller, 1873.

2. Family OBOLIDÆ King, 1846.

Obolinæ Gill, 1871.

Thick-shelled Obolacea of nearly circular or ovoid outline, biconvex, usually smooth, with rudimentary cardinal areas traversed by shallow

[1] Since in this classification no superordinal terms are for the present adopted, it will be well to give here all such terms used by authors and others which are of lower rank and not readily referred as synonyms to their proper places:

Ancylobrachia Ancylopoda, Helictopoda, Sarcicobrachia Gray, 1848; Lyopomata and Arthropomata Owen, 1858; Pleuropygia, Sarcicobranchiona, Sclerobranchiona Bronn, 1862; Articulata and Inarticulata Huxley, 1864; Clistenterata and Tretenterata King, 1873.

[2] Text book of Paleontology, by Zittel and Eastman, 1896, p. 305. Also see page 78 of this bulletin.

[3] The numbers and letters before a family or subfamily term indicate the phyletic relations which these have to one another within a superfamily. The phylogeny of the families, however, is more clearly represented in the diagram on Pl. I, facing p. 134.

[4] Recent discoveries have shown that Iphidea has no pedicle opening, and should include forms referred to Paterina. Therefore this family is of doubtful value, and is provisionally retained for the reception of genera more primitive in structure than those of the Obolidæ.

pedicle grooves. Muscular scars distinct, consisting of two pairs of adductors and three of sliders, or adjustors.

Obolella Billings, 1861.
  Dicellomus Hall, 1871.
Elkania Ford, 1886.
  Billingsia Ford, 1886.
Neobolus Waagen, 1885.
Botsfordia Matthew, 1893.
†Spondylobolus McCoy, 1852.
Obolus Eichwald, 1829.
  Ungula Pander, 1830.
  Ungulites Bronn, 1848.
  Aulontreta Kutorga, 1848.
  Euobolus Mickwitz, 1896.
Acritis Volborth, 1869.
Schmidtia Volborth, 1869 (not Bals-Criv., 1863).
Thysanotos Mickwitz, 1896.
Leptembolon Mickwitz, 1896.

3. Family TRIMERELLIDÆ Davidson and King, 1874.

Large, thick-shelled, inequivalved Obolacea, with the ventral cardinal area usually very prominent, triangular, and transversely striated. Adjustors and anterior adductor muscles elevated upon solid or deeply excavated platforms, or spondylia.

†Lakmina Œhlert, 1887.
  Davidsonella Waagen, 1885 (not Munier-Chalmas, 1880).
Lingulobolus Matthew, 1896.
Sphærobolus Matthew, 1896.
Dinobolus Hall, 1871.
  Conradia Hall, MS., 1862.
  Obolellina Billings, 1871.
  Ungulites Quenstedt, 1871 (not Bronn, 1848).
Monomorella Billings, 1871.
Trimerella Billings, 1862.
  Gotlandia Dall, 1870.
Rhinobolus Hall, 1874.

Superfamily **LINGULACEA** Waagen, 1885 (restricted).[1]

Elongate, thin-shelled, burrowing, derived Atremata, with a more or less long, worm-like, tubular, flexible pedicle.

1. Family LINGULELLIDÆ Schuchert, 1893.

Spatulate, inequivalved Lingulacea, structurally intermediate between the Obolidæ and Lingulidæ.

Lingulella Salter, 1866.
Lingulepis Hall, 1863.
Leptobolus Hall, 1871.
†Paterula Barrande, 1879.
  Cyclus Barrande, 1879.
†Mickwitzia Schmidt, 1888.

[1] Waagen's term Mesokaulia, or Lingulacea, is based upon the families Obolidæ, Trimerellidæ, and Lingulidæ. Since this term has value, and to avoid proposing another, Lingulacea is here restricted to the latter family and two others recently proposed. Waagen in using this term gave a dual series; the second one is here adopted to conform in euphony with other superfamily terms.

2. Family LINGULIDÆ Gray, 1840.

Lingulidæ Gill, 1871.

Attenuate, subquadrate or spatulate, almost equivalved Lingulacea, derived through Lingulellidæ, with a more or less long, tubular, flexible pedicle. Muscles highly differentiated and consisting of six pairs, two of adductors, and four of sliders, or adjustors.

Lingula Bruguière, 1792.
Pharetra Bolton, 1798.
Lingularius Duméril, 1806.
Glossina Phillips, 1848.
Dignomia Hall, 1871.
Glottidia Dall, 1870.
Barroisella Hall and Clarke, 1892.
Tomasina Hall and Clarke, 1892.

3. Family LINGULASMATIDÆ Winchell and Schuchert, 1893.

Platform-bearing Lingulacea derived through Lingulidæ.

Lingulops Hall, 1871.
Lingulasma Ulrich, 1889.
Lingulelasma Miller, 1889.

Order TELOTREMATA Beecher, 1891.

Sclerobrachia Gray, 1848; Kampylopegmata (partim) Waagen, 1883; Pegmatobranchiata (partim) Neumayr, 1883.

Articulate Brachiopoda, with the pedicle opening shared by both valves in nepionic and early neanic stages, usually confined to one valve in later stages, and becoming more or less modified by deltidial plates in ephebic stages. Brachia supported by calcareous crura, loops, or spiralia. Prodeltidium absent.

Superfamily RHYNCHONELLACEA Schuchert, 1896.[1]

Rostracea Schuchert, 1893; Ancistropegmata (partim) Zittel, 1895.

Rostrate, primitive Telotremata, with or without crura.

1. Family PROTORHYNCHIDÆ Schuchert, 1896.[1]

Primitive Rhynchonellacea, without deltidial plates or crura.

Protorhyncha Hall and Clarke, 1893.

2. Family RHYNCHONELLIDÆ Gray, 1848.

Hypothyridæ (partim) King, 1850; Rhynchonellinæ Gill, 1871; Waagen, 1883.

Rhynchonellacea with more or less long crura.

[1] Text-book of Paleontology, by Zittel and Eastman, 1896, p. 323.

Orthorhynchula Hall and Clarke, 1893.
Rhynchotrema Hall, 1860.
Stenochisma Conrad, 1839; Hall, 1867.
Rhynchotreta Hall, 1879.
Camarotœchia Hall and Clarke, 1893.
Plethorhynchus Hall and Clarke, 1893.
Leiorhynchus Hall, 1860.
Wilsonia Kayser, 1871.
Uncinulina Bayle, 1878.
Uncinulus Bayle, 1878.
Hypothyris King, 1846 (not Phillips, 1841).
Pugnax Hall and Clarke, 1893.
Eatonia Hall, 1857.
Cyclorhina Hall and Clarke, 1893.
Rhychopora King, 1856.
Rhynchoporina Œhlert, 1887.
Terebratuloidea Waagen, 1883.
Rhynchonella Fisher de Waldheim, 1809.
Oxyrhynchus Llhwyd, 1699 (not Aristotle).
Rhyngonella Bronn, 1849.
Bicornes Quenstedt, 1851.
Rhynchonellopsis Bose, 1894.
Halorella Bittner, 1890.
Austriella Bittner, 1890.
Norella Bittner, 1890.
Peregrinella Œhlert, 1887.
Rhynchonellina Gemmelaro, 1871.
Dimerella Zittel, 1870.
Acanthothyris d'Orbigny, 1850.
Hemithyris d'Orbigny, 1847.
Frieleia Dall, 1895.
Cryptopora Jeffreys, 1869.
Atretia Jeffreys, 1876.
Neatretia Œhlert, 1891.

Superfamily **TEREBRATULACEA** Waagen, 1883 (restricted).[1]

Ancylopoda, Cryptobrachia, and Ancylobrachia (partim) Gray, 1848; Kampylopegmata Waagen, 1883; Ancylopegmata Zittel, 1895.

Derived Telotremata with the brachia supported by calcareous, primitive, or metamorphosed loops.

Section A. *TEREBRATULA.*

Terebratulacea with the loops unsupported by a median dorsal septum at any stage of growth. Brachial cirri directed outward in larval stages.

1. Family CENTRONELLIDÆ Hall and Clarke, 1895.[2]

Centronellinæ Waagen, 1882; Beecher, 1893; Rensselæridæ Hall and Clarke, 1895.

Terebratulas with the loop developing direct and composed of two descending lamellæ, uniting in the median line and forming a broad, arched plate.

[1] Terebratulacea Waagen is used here in preference to Ancylobrachia Gray, in violation of the law of priority, for the sake of euphony.

[2] Since Beecher's "Revision of the families of loop-bearing Brachiopoda" (Trans. Conn. Acad., Vol. IX, 1893), it has been shown by Beecher and Schuchert (Proc. Biol. Soc. Washington, Vol. VIII, 1893) that the loop in the family Terebratulidæ, as limited in the former paper, does in part pass through a short series of metamorphoses. This necessitates the removal of Centronellinæ from the family Terebratulidæ, since its loops remain essentially without change throughout growth.

Rensselæria Hall, 1859.
Beachia Hall and Clarke, 1893.
Newberria Hall, 1891.
Rensselandia Hall, 1867.
Oriskania Hall and Clarke, 1893.
Trigeria (Bayle, 1875?) Hall and Clarke, 1893.
?Scaphiocœlia Whitfield, 1891.
Centronella Billings, 1859.
Cryptonella Hall, 1863 (not 1861 and 1867).
Chascothyris Holzapfel, 1895.
Selenella Hall and Clarke, 1893.
Rominigerina Hall and Clarke, 1893.
Juvavella Bittner, 1888.
Juvavellina Bittner, 1896.
Nucleatula (Zugmayer) Bittner, 1890.
Dinarella Bittner, 1892.
?Lissopleura Whitfield, 1896.

2. Family TEREBRATULIDÆ Gray, 1840.

Terebratulas developing originally a Centronella-like loop, and thence by a short series of metamorphoses resulting at maturity in a free loop of varying form.

Subfamily STRINGOCEPHALINÆ Dall, 1870.

Stringocephalidæ King, 1850; Davidson, 1853.

Terebratulidæ with a "long loop, following the margin of the dorsal valve, not recurved in front. Probably no median coiled arm" (Beecher).[1]

Stringocephalus Defrance, 1827.

2a. Subfamily MEGALANTERINÆ Waagen, 1882.

Terebratulidæ with a long loop having ascending branches.

Megalanteris Œhlert, 1887.
Meganteris Suess, 1855.
?Cryptacanthia White and St. John, 1868.
Cryptonella Hall (1861?), 1867.
Harttina Hall and Clarke, 1893.

2a[a]. Subfamily TEREBRATULINÆ Dall, 1870.

Terebratulidæ with a short loop. "A median unpaired coiled arm exists in recent genera" (Beecher).

Eunella Hall and Clarke, 1893.
Cranæna Hall and Clarke, 1893.
Dielasma King, 1859.
Epithyris King, 1850 (not Phillips, 1841).
Seminula McCoy, 1855 (not 1844).
Dielasmina Waagen, 1882.
Notothyris Waagen, 1882.
Zugmeyeria Waagen, 1882.
Dictyothyris Douvillé, 1880.
Glossothyris Douvillé, 1880.
Pygope Link, 1830.

[1] The ontogenetic history of Stringocephalus is not known. Its mature loop, however, is so different from that of the Centronellidæ that it appears probable that this appendage passed through a short series of changes, and therefore the reference of this subfamily to the Terebratulidæ.

Beecheria Hall and Clarke, 1893.
Hemiptychina Waagen, 1882.
Rhætina Waagen, 1882.
Terebratula Klein, 1753.
Terebratula Llhwyd, 1699.
Sacculus Llhwyd, 1699.
Lampas Meuschen, 1787.
Terebratularius Duméril, 1806.
Nucleata Quenstedt, 1871.
Musculus Quenstedt, 1871 (not Klein, 1753).
Diphyites Schroter, 1799.
Pugites de Hann, 1833.
Antinomia Catullo, 1850.
Propygope Bittner, 1890.
Liothyrina Œhlert, 1887.
Epithyris Deslongchamps, 1862 (not King, 1848).
Gryphus Megerle, 1811 (not Brisson, 1760).
Liothyris Douvillé, 1880 (not Conrad, 1875).
Terebratulina d'Orbigny, 1847.
? Disculina Deslongchamps, 1884.

2a[b]. Subfamily DISCOLIINÆ Beecher, 1893.

Discoliidæ Fischer and Œhlert, 1892.

Terebratulidæ with the "loop short and continuous with the cirrated edge of the lophophore. No coiled median arm" (Beecher).

Discolia Fischer and Œhlert, 1890.
Eucalathis Fischer and Œhlert, 1890.
? Agulhasia King, 1871.

Section B. *TEREBRATELLA.*

Terebratulacea with the loop supported by a median dorsal septum throughout life, or only in the younger stages. Brachial cirri directed inward during larval stages. This section has two phyla having a common origin now geographically separated in two provinces, one austral, the other boreal.

1. Family TEREBRATELLIDÆ King, 1850 (emend Beecher, 1893).

Waldheimidæ Douvillé, 1880; Waldheimiinæ Waagen, 1882.

Terebratulacea with the "loop in the higher genera composed of two primary and two secondary lamellæ, passing through a series of distinct metamorphoses while attached to a dorsal septum" (Beecher).

1. Subfamily TROPIDOLEPTIINÆ Schuchert, 1896.[1]

Terebratellidæ with the loop consisting of two slender descending branches, uniting with a high, vertical septum. Apparently the ancestral stock for the Terebratellidæ.

Tropidoleptus Hall, 1859.

[1] Text-book of Paleontology, by Zittel and Eastman, 1896, p. 330.

1a. Subfamily MEGATHYRINÆ Dall, 1870 (emend Beecher, 1893).

Argiopidæ King, 1850; Megathyridæ Œhlert, 1887; Argiopidæ Davidson, 1884; Argiopinæ Davidson, 1887.

Terebratellidæ in which the "loop is composed of descending branches only, passing in the highest genus through stages correlative with Gwynia, Cistella, and Megathyris. The lower genera do not complete the series" (Beecher). The original stock for the two following subfamilies:

Megathyris d'Orbigny, 1847.
  Argiope Deslongchamps, 1842 (not Savigny and Audouin, 1827).
Zellania Moore, 1854.
Gwynia King, 1859.
Cistella Gray, 1850.

1a[a]. Subfamily DALLINÆ Beecher, 1893.[1]

Platidiinæ Dall, 1870.

Terebratellidæ with the "loop composed of descending and ascending lamellæ, passing in the highest genera through metamorphoses comparable to the adult structure of Platidia, Ismenia, Mühlfeldtia, Terebratalia, and Dallina. The lower genera, therefore, do not progress to the final stages" (Beecher). Recent genera restricted to boreal seas.

Dallina Beecher, 1893.
Macandrevia King, 1859.
Terebratalia Beecher, 1893.
Lacqueus Dall, 1870.
  Frenula Dall, 1871.
Frenulina Dall, 1895.
Mühlfeldtia Bayle, 1880.
  Megerlia King, 1850 (not Robineau Desvoidy, 1830).
Platidia Costa, 1852.
  Morrisia Davidson, 1852.
Ismenia King, 1850 (not Dall, 1871).
Kingena Davidson, 1852.
  Kingia Schoenbach, 1867.
Trigonosemus Koenig, 1825.
  Fissurirostra d'Orbigny, 1847.
  Fissirostra d'Orbigny, 1847.
  Delthyridea King, 1850.
Lyra Cumberland, 1816.
  Terebrirostra d'Orbigny, 1847.
Eudesia King, 1850.
  Orthotoma Quenstedt, 1871.
  Trigonella Quenstedt, 1871.
  Flabellothyris Deslongchamps, 1884.
Zeilleria Bayle, 1878.
Fimbriothyris Deslongchamps, 1884.
Microthyris Deslongchamps, 1884.
  Ornithella Deslongchamps, 1884.
Aulacothyris Douvillé, 1880.
Camerothyris Bittner, 1890.
Epicyrta Deslongchamps, 1884.
Cincta Quenstedt, 1871.
Antiptychina Zittel, 1883.
Plesiothyris Douvillé, 1880.
?Hynniphoria Suess, 1858.
?Cruratula Bittner, 1890.
?Orthoidea Friren, 1875.

[1] Since many of the fossil genera here referred to this family have not been studied in the light of Beecher's and Œhlert's recent researches, it is not known that all belong to this boreal stock.

1a[b]. Subfamily MAGELLANINÆ Beecher, 1893.

Waldheimidæ (partim) Douvillé, 1880; Terebratellinæ and Magasinæ Davidson, 1887; Magasidæ (partim) d'Orbigny, 1847; King, 1850; Rhynchoridæ (partim) King, 1850; Mühlfeldtiinæ Œhlert, 1887; Kraussininæ Dall, 1870; Kraussidæ Davidson, 1870.

Terebratellidæ with the "loop composed of descending and ascending branches, passing in the higher genera through metamorphoses comparable to the adult structure of Bouchardia, Magas, Magasella, Terebratella, and Magellania. The lower genera become adult before reaching the terminal stages" (Beecher). Recent genera are restricted to austral seas.

Magellania Bayle, 1880.
- Waldheimia King, 1850 (not Brulle, 1846).
- Neothyris Douvillé, 1880.

Terebratella d'Orbigny 1847.
- Delthyris Menke, 1830 (not Dalman, 1828).
- Ismenia King, 1850 (not Dall, 1870).
- Waltonia Davidson, 1850.

Magasella Dall, 1870.

Rhynchorina Œhlert, 1887.

Magas Sowerby, 1816.

Megerlina Deslongchamps, 1884.

Bouchardia Davidson, 1849.
- Pachyrhynchus King, 1850.

Kraussina Davidson, 1859.
- Kraussia Davidson, 1852 (not Dana, 1852).

Cœnothyris Douvillé, 1880.

Mannia Dewalque, 1874.

? Rhynchora Dalman, 1828.

Superfamily SPIRIFERACEA Waagen, 1883.

Helicopegmata Waagen, 1883.

Telotremata with the adult brachia supported by calcareous spiral lamellæ or spiralia.

1. Family ATRYPIDÆ Gill, 1871.

Atrypidæ Dall, 1877.

Spiriferacea with the crura directly continuous with the primary lamellæ, which diverge widely and have the spiral cones between them. Jugum simple, complete or incomplete.

1a. Subfamily ZYGOSPIRINÆ Waagen, 1883.

Anazygidæ Davidson, 1884; Zygospiridæ Hall and Clarke, 1895.

Atrypidæ with a simple jugum either posteriorly or anteriorly directed. Spiralia with their apices toward the median dorsal region.

Zygospira Hall, 1862.
- Stenocisma Hall, 1864 (not Conrad, 1839; Hall, 1867).
- Anazyga Davidson, 1882.
- Orthonomæa Hall, 1858.
- Hallina Winchell and Schuchert, 1892.
- Protozyga Hall and Clarke, 1893.

Catazyga Hall and Clarke, 1893.

Atrypina Hall and Clarke, 1893.

Glassia Davidson, 1882.

? Clintonella Hall and Clarke, 1893.

Subfamily DAYINÆ Waagen, 1883.

Atrypidæ with the jugum drawn out posteriorly into a simple short process. Spiralia laterally directed.

Dayia Davidson, 1882.

1a*. Subfamily ATRYPINÆ Waagen, 1883.

Atrypidæ with the jugum situated extremely posterior, complete in young stages, but at maturity discontinuous. Spiralia dorso-medially directed.

Atrypa Dalman, 1828.
- Cleiothyris Phillips, 1841 (not King, 1830).
- Spirigerina d'Orbigny, 1874.

Gruenewaldtia Tschernyschew, 1885.

?Karpinskya Tschernyschew, 1885.

2. Family SPIRIFERIDÆ King, 1846 (emend Davidson).

Martiniinæ and Reticulariinæ Waagen, 1883; Spiriferinidæ Davidson, 1884.

Spiriferacea with the crura directly continuous with the bases of the primary lamellæ, which are situated between the laterally directed spiralia. Jugum simple, complete or incomplete.

2a. Subfamily SUESSIINÆ Waagen, 1883.

Spiriferidæ with the jugum continuous and more or less V-shaped. Shell structure punctate.

Cyrtina Davidson, 1858.

Theocyrtella Bittner, 1892.
- Cyrtotheca Bittner, 1890 (not Salter).

Spiriferina d'Orbigny, 1847.

Suessia Deslongchamps, 1854.

Subfamily UNCITINÆ Waagen, 1883.

Spiriferidæ (?) with the jugum as in Suessiinæ. Just within the posterior margin of the dorsal valve are pouch-like plates. Deltidial plates united, deeply concave. Subfamily anomalous.

Uncites Defrance, 1825.

?Uncinella Waagen, 1883.

2b. Subfamily TRIGONOTRETINÆ Schuchert, 1893.

Delthyrinæ (partim) Waagen, 1883.

Spiriferidæ with the jugum at maturity discontinuous, represented by two short jugal processes, one attached to each primary lamella.

?Cyclospira Hall and Clarke, 1893.

Spirifer Sowerby, 1815.
- Choristites Fisher de Waldheim, 1825.
- Trigonotreta Koenig, 1825; Meek and Hayden, 1864.
- Spiriferus Blainville, 1827.
- Spirifera J. de C. Sowerby, 1835.
- Brachythyris McCoy, 1844.
- Fusella McCoy, 1844.
- Hysterolithus Quenstedt, 1871.

Cyrtia Dalman, *1828.*

Syringothyris Winchell, 1863.
- Spirifer Meek and Hayden, 1864.

Delthyris Dalman, 1828.

Martinia McCoy, 1844.

Martiniopsis Waagen, 1883.

Mentzelia Quenstedt, 1871.

Ambocœlia Hall, 1860.

Reticularia McCoy, 1844.

Verneuilia Hall and Clarke, 1893.

?Metaplasia Hall and Clarke, 1893.

3. Family ATHYRIDÆ Phillips, 1841.

Nucleospiridæ Davidson, 1882; Koninckinidæ Davidson, 1853.

Spiriferacea with the bases of the primary lamellæ situated between the spiralia, and sharply recurved dorsally at their junction with the crura. Spiralia more or less laterally directed. Jugum complete, V-shaped, with the apex drawn out into a simple, bifurcated, or otherwise modified process.

3a. Subfamily RHYNCHOSPIRINÆ Schuchert, 1894.

Retziinæ Waagen, 1883; Retziidæ and Rhynchospiridæ Hall and Clarke, 1895.

Athyridæ with the single process of the jugum commonly recurved, but sometimes bifurcated. Shell structure distinctly punctate.

Homœospira Hall and Clarke, 1893.
Rhynchospira Hall, 1859.
Ptychospira Hall and Clarke, 1893.
Eumetria Hall, 1864.
Trematospira Hall, 1857.
Parazyga Hall and Clarke, 1893.
Acambona White, 1862.
Hustedia Hall and Clarke, 1893.
Retzia King, 1850.
  Trigeria Bayle, 1878.

3ª. Subfamily HINDELLINÆ Schuchert, 1894.

Cœlospiridæ and Nucleospiridæ Hall and Clarke, 1895.

Athyridæ in which the jugum has a single process which may be simple, or it articulates in a ventral septal socket, and sometimes (rarely) is sharply recurved terminally. Shell structure impunctate.

Hindella Davidson, 1882.
Whitfieldella Hall and Clarke, 1893.
  Meristina Davidson, 1882 (not Hall, 1867).
Nucleospira Hall, 1858.
Hyattella Hall and Clarke, 1893.
Anoplotheca Sandberger, 1856.
  Bifida Davidson, 1882.
Cœlospira Hall, 1863.
  Leptocœlia Hall, 1857, 1859.
Vitulina Hall, 1860.
?Anabia Clarke, 1893.

3ᵇ. Subfamily ATHYRINÆ Waagen, 1883.

Athyridæ in which the single process of the jugum bifurcates. The branches may or may not terminate between the first and second volutions of the spiralia.

Meristina Hall, 1867.
  Athyris Davidson, 1853 (not McCoy, 1844).
  Whitfieldia Davidson, 1882.
Glassina Hall and Clarke, 1893.
Athyris McCoy, 1844.
  Spirigera d'Orbigny, 1847.
  Euthyris Quenstedt, 1871.
Actinoconchus McCoy, 1844.
Torynifer Hall and Clarke, 1895.
Cleiothyris King, 1840 (not Phillips, 1841).
Seminula McCoy, 1844.
Spirigerella Waagen, 1883.
Anomactinella Bittner, 1890.
Pomatospirella Bittner, 1892.
Amphitomella Bittner, 1890.
Tetractinella Bittner, 1890.
  Plicigera Bittner, 1890.
Pentactinella Bittner, 1890.

3c. Subfamily DIPLOSPIRINÆ Schuchert, 1894.

Athyridæ (partim) Hall and Clarke, 1895.

Athyridæ with the jugal bifurcations very long, lying between the volutions of the spiralia, and continuing with these to their outer ends. Sometimes there is an additional jugal process which articulates with the ventral valve, or recurves and joins the jugum.

Kayseria Davidson, 1882.
Diplospirella Bittner, 1890.
Euractinella Bittner, 1890.
Pexidella Bittner, 1890.
Anisactinella Bittner, 1890.
?Didymospira Salomon.

3bb. Subfamily KONINKININÆ Waagen, 1883.

Koninckinidæ Davidson, 1853; Amphiclininæ Waagen, 1883; Diplospidæ and Diplospiridæ Munier-Chalmas, 1880.

Athyridæ with jugum and spiralia essentially as in Diplospiridæ. The spiralia in Koniuckiniuæ, however, are not laterally directed as in the former group, but point ventrally, this being due to the concave form of the dorsal shell.

Koninckina Suess, 1853.
Amphiclina Laube, 1865.
Koninckella M.-Chalmas, 1880.
Koninckodonta Bittner, 1893.
?Thecospira Zugmeyer, 1880.
?Amphiclinodonta Bittner, 1890.

3ba. Subfamily MERISTELLINÆ Waagen, 1883.

Meristellidæ Hall and Clarke, 1895.

Athyridæ in which the jugal bifurcations do not enter the spiralia, but recurve and join near their origin.

Meristella Hall, 1860.
Charionella Billings, 1861.
?Pentagonia Cozzens, 1846.
Goniocœlia Hall, 1861.
Dicamara Hall and Clarke, 1893.
Merista Suess, 1851.
Camarium Hall, 1859.
Dioristella Bittner, 1890.
?Camarospira Hall and Clarke, 1893.

Order NEOTREMATA Beecher, 1891.

Circular or oval, more or less cone-shaped, inarticulate Brachiopoda, with the pedicle opening restricted throughout life to the ventral valve. Pedicle aperture modified by a deltidium or listrium. Prodeltidium attached to the ventral valve.

Superfamily ACROTRETACEA Schuchert, 1896.[1]

Daikaulia (partim) Waagen, 1885; Diacaulia Hall and Clarke, 1895.

Neotremata with phosphatic shells and a more or less well-developed pseudodeltidium. Dorsal protegulum marginal.

[1] Text-book of Paleontology, by Zittel and Eastman, 1896, p. 308.

1. Family ACROTRETIDÆ Schuchert, 1893.

Acrotretacea with the pedicle opening posterior to the protegulum.

Acrothele Linnarsson, 1876.
Linnarssonia Walcott, 1885.
Discinopsis (Matthew) Hall and Clarke, 1892.
Acrotreta Kutorga, 1848.
Conotreta Walcott, 1889.
†Mesotreta Kutorga, 1848.
†Orbicella d'Orbigny, 1849.
Keyserlingia Pander, 1861.
†Helmersenia Pander, 1861.

2. Family SIPHONOTRETIDÆ Kutorga, 1848.

Acrotretacea with the pedicle opening passing by resorption anteriorly through the protegulum and the umbo of the shell.

Yorkia Walcott, 1897.
Trematobolus Matthew, 1893.
Siphonotreta de Verneuil, 1845.
Protosiphon Matthew, 1897.
Schizambon Walcott, 1884.
Schizambonia Œhlert, 1887.

Superfamily **DISCINACEA** Waagen, 1885.

Daikaulia (partim) Waagen, 1885; Diacaulia (partim) Hall and Clarke, 1895.

Neotremata with phosphatic shells, a listrium, but with no deltidium. Dorsal protegulum usually subcentral.

1. Family TREMATIDÆ Schuchert, 1893.

Primitive Discinacea, in which the posterior margin of the ventral valve has a triangular pedicle notch throughout life. A listrium is usually present.

Discinolepis Waagen, 1885.
Trematis Sharpe, 1847.
Orbicella Hall and Whitfield, 1875 (not d'Orbigny, 1849).
Schizocrania Hall and Whitfield, 1875.
Schizobolus Ulrich, 1886.
Lingulodiscina Whitfield, 1890.
Œhlertella Hall and Clarke, 1890.
? Monobolina Salter, 1865.

2. Family DISCINIDÆ Gray, 1840.

Orbiculidæ McCoy, 1844.

Derived Discinacea with an open pedicle notch in early life in the posterior margin of the ventral valve, which is closed posteriorly during neanic growth, leaving a more or less long, narrow slit partially closed by the listrium.

Orbiculoidea d'Orbigny, 1847.
Schizotreta Kutorga, 1848.
Lindstrœmella Hall and Clarke, 1890.
Rœmerella Hall and Clarke, 1890.
Discina Lamarck, 1819.
Orbicula Sowerby, 1830 (not Cuvier, 1798).
Discinisca Dall, 1871.

Superfamily CRANIACEA Waagen, 1885.[1]

Gasteropegmata Waagen, 1885.

Cemented calcareous Neotremata without pedicle or anal openings at maturity.

Family CRANIIDÆ King, 1846.

Orbiculæ Deshayes, 1830; Craniadæ Gray, 1840.

Craniacea with the pedicle functional probably only during nepionic growth.

Crania Retzius, 1781.
- Nummulus Stoeboeus, 1732.
- Ostracites Beuth, 1776.
- Criopus Poli, 1791.
- Criopoderma Poli, 1795.
- Orbicula Cuvier, 1798 (not Sowerby, 1830).
- Orbicularius Duméril, 1806.
- Craniolites Schlotheim, 1820.
- Discina Turton, 1832 (not Lamarck, 1819).
- Criopododerma Agassiz, 1846.
- Choniopora Schauroth, 1854.

Craniella Œhlert, 1888.

Cardinocrania Waagen, 1885.

Ancistrocrânia Dall, 1877.
- Cranopsis Dall, 1871 (not A. Adams).

Craniscus Dall, 1871.
- Siphonaria Quenstedt, 1851 (not Sowerby).

Pholidops Hall, 1860.
- Craniops Hall, 1859.

Pseudocrania McCoy, 1851.
- Palæocrania Quenstedt, 1871.

Order PROTREMATA Beecher, 1891.

Derived, articulate Brachiopoda, with the pedicle opening restricted to the ventral valve throughout life or during early growth. Prodeltidium originating on the dorsal side of the body wall in the cephalula stage, and later anchylosed to the ventral shell, thus initiating the development of a deltidium. Pedicle aperture modified by the deltidium. Brachia unsupported by a calcareous skeleton except in the Pentameracea where there are crura.

Superfamily STROPHOMENACEA Schuchert, 1896.[2]

Lineicardines (partim) and Denticardines (partim) Bronn, 1862; Aphaneropegmata (partim), Productacea, Coralliopsida, and Kampylopegmata (partim) Waagen, 1883; Eleutherobranchiata (partim) Neumayr, 1883; Cryptobrachia (partim) Gray, 1848; Thecacea Schuchert, 1893.

Primitive Protremata without spondylia and cruralia.

Family KUTORGINIDÆ Schuchert, 1893.

Primitive Strophomenacea with incipient cardinal areas, great delthyrial opening, and very rudimentary articulating processes and deltidium.

Kutorgina Billings, 1861 (emend Walcott).

?Schizopholis Waagen, 1885.

[1] The writer believes that when the young growth stages of Crania are studied it will be shown that the Craniacea have the superfamily characters of Acrotretacea rather than those of Discinacea.

[2] Text-book of Paleontology, by Zittel and Eastman, 1896, p. 312.

? Family EICHWALDIIDÆ Schuchert, 1893.[1]

Primitive or aberrant, rostrate Strophomenacea, with narrow lateral grooves and ridges for articulation. Delthyrium closed by a concave plate (?deltidium). Pedicle emerging through the ventral umbone and moving with growth anteriorly by resorption through the shell, as in Siphonotretidæ.

Eichwaldia Billings, 1858.

Dictyonella Hall, 1867.

1. Family BILLINGSELLIDÆ Schuchert, 1893.

Strophomenacea with well-developed cardinal areas and deltidium. Cardinal process obsolete or very rudimentary. Articulation fairly well developed.

Billingsella Hall and Clarke, 1892.
Protorthis Hall and Clarke, 1892.

2. Family STROPHOMENIDÆ King, 1846.

Strophomenacea with well-developed cardinal areas, deltidium, chilidium, cardinal and articulating processes.

2a. Subfamily RAFINESQUININÆ Schuchert, 1893.

Leptænacea Braun, 1840; Orthisidæ (partim) d'Orbigny, 1847; Davidsonidæ King, 1850; Davidsoninæ Gill, 1871; Strophomeninæ (partim) Gill, 1871; Waagen, 1884; Cadomellinæ Munier-Chalmas, 1887; Leptænidæ Hall and Clarke, 1895.

Strophomenoids with ventral valve convex and dorsal concave, except in Strophonella. The relative form of the valves is the reverse of the Orthothetinæ.

Rafinesquina Hall and Clarke, 1892.

Leptæna Dalman, 1828.
- Leptagonia McCoy, 1844.
- Strophomena Meek, 1873 (not Blainville, 1825).
- Plectambonites Œhlert, 1887 (not Pander, 1830).

Strophеodonta Hall, 1852.
- Brachyprion Shaler, 1865.
- Douvillina Œhlert, 1887.

Leptostrophia Hall and Clarke, 1892.

Pholidostrophia Hall and Clarke, 1892.

Strophonella Hall, 1879.
- Amphistrophia Hall and Clarke, 1892.

Cadomella M.-Chalmas, 1887.

Leptella Hall and Clarke, 1892.

Plectambonites Pander, 1830.
- Leptæna Davidson, 1853; Œhlert, 1877 (not Dalman, 1828).

Leptænisca Beecher, 1890.

Christiania Hall and Clarke, 1892.

Davidsonia Bouchard, 1847.

[1] In 1893 the writer referred this family with doubt to the Rhynchonellacea. The absence of crural plates in Eichwaldia forbids that disposition. If the concave plate closing the umbonal pedicle passage is a deltidium, there can be no doubt that this family belongs to the Protremata. Students should search for the very young of Eichwaldia or Dictyonella, since it is through ontogeny alone *that the true systematic* position of this family will be determined.

2b. Subfamily ORTHOTHETINÆ Waagen, 1884.

Strophomeninæ (partim) Waagen, 1884.

Strophomenoids with the ventral valve convex during early growth, becoming subsequently concave.

- ?Orthidium Hall and Clarke, 1892.
- Strophomena Blainville, 1825.
  - Hemipronites Meek, 1872 (not Pander, 1830).
- Orthothetes Fischer de Waldheim, 1837.
  - Orthis King, 1850 (not Dalman, 1828).
- Hipparionyx Vanuxem, 1842.
- Streptorhynchus King, 1850.
- Derbya Waagen, 1884.
- Kayserella Hall and Clarke, 1892.
- Meekella White and St. John, 1870.
- Triplecia Hall, 1859.
  - Dicraniscus Meek, 1872.
- Mimulus Barrande, 1879.
- Streptis Davidson, 1881.

3. Family THECIDIIDÆ Gray, 1840.

Cemented Strophomenacea in which the interior of the shell is impressed with variously indented brachial furrows.

3a. Subfamily LYTTONIINÆ Waagen, 1883.

Thecidiidæ with the brachial markings common to both valves.

- Lyttonia Waagen, 1883.
  - Leptodus Kayser, 1882.
- Oldhamina Waagen, 1883.

3b. Subfamily THECIDIINÆ Dall, 1870.

Thecidiidæ with the brachial markings restricted to the dorsal valve.

- Thecidia Defrance, 1822.
  - Thecidium Sowerby, 1824.
- Lacazella M.-Chalmas, 1880.
- Thecidiopsis M.-Chalmas, 1887.
- Thecidella M.-Chalmas, 1887.
- Eudesella M.-Chalmas, 1880.
- Pterophloios Gümbel, 1861.
  - Bactrynium Emmerich, 1855. (In error. Not Bactrillium Herr.)
- Davidsonella M.-Chalmas, 1880.

2aa. Family PRODUCTIDÆ Gray, 1840.

Productina Giebel, 1846.

Strophomenacea with hollow anchoring spines.

2aaa. Subfamily CHONETINÆ Waagen, 1884.

Chonetidæ Bronn, 1862; Hall and Clarke, 1895.

Productidæ with the anchoring spines restricted to the ventral cardinal margin.

- Chonetes Fischer de Waldheim, 1837.
  - Leptæna McCoy, 1844 (not Dalman, 1828).
- Anoplia Hall and Clarke, 1892.
- Chonetella Waagen, 1884.
- Chonostrophia Hall and Clarke, 1892.
- Chonetina Krotow, 1888.
  - Chonetella Krotow, 1884 (not Waagen, 1884).

2a[a1]. Subfamily PRODUCTINÆ Waagen, 1884.

Productidæ with the anchoring spines more or less abundant over the ventral valve and sometimes also over the dorsal valve.

Daviesiella Waagen, 1884.
Productella Hall, 1867.
Productus Sowerby, 1812.
  Pyxis Chemnitz, 1784.
  Producta G. B. Sowerby, 1825.
  Arbusculites Murray, 1831.
  Protonia Linck, 1830 (not Rafinesque).
  Marginifera Waagen, 1884.
Proboscidella Œhlert, 1887.
Etheridgina Œhlert, 1887.
Chonopectus Hall and Clarke, 1892.
Strophalosia King, 1844.
  Orthothrix Geinitz, 1847.
  Leptænalosia King, 1845.
Aulosteges von Helmersen, 1847.
?Aulacorhynchus Dittmar, 1871.
  Isogramma Meek and Worthen, 1873.

2a[a2]. Family RICHTHOFENIDÆ Waagen, 1885.

Strophomenacea probably derived through the Productidæ, and remarkably modified by ventral cementation. The form of the shell is that of cyathophylloid corals with an operculiform dorsal valve. Shell structure cystose.

Richthofenia Kayser, 1881.

1a. Family ORTHIDÆ Woodward, 1852.

Orthisidæ (partim) d'Orbigny, 1847; Orthinæ and Enteletinæ Waagen, 1884.

Strophomenacea usually with large open delthyria; deltidium only developed in younger growth stages.

Orthis Dalman, 1828.
  Orthambonites Pander, 1830.
Plectorthis Hall and Clarke, 1892.
Hebertella Hall and Clarke, 1892.
Schizophoria King, 1850.
Orthotichia Hall, 1892.
Enteletes Fischer de Waldheim, 1830.
  Syntrielasma Meek, 1865.
Platystrophia King, 1850.
Orthotropia Hall and Clarke, 1895.
Dinorthis Hall and Clarke, 1892.
  Plæsiomys Hall and Clarke, 1892.
Orthostrophia Hall, 1883.
Dalmanella Hall and Clarke, 1892.
Heterorthis Hall and Clarke, 1892.
Bilobites Linné, 1775.
  Dicœlosia King, 1850.
Rhipidomella Œhlert, 1890.
  Rhipidomys Œhlert, 1887 (not Wagner).

Superfamily PENTAMERACEA Schuchert, 1896.[1]

Trullacea Schuchert, 1893; Ancistropegmata (partim) Zittel, 1895; Aphaneropegmata (partim) and Productacea (partim) Waagen, 1883; Eleutherobranchiata (partim) Neumayr, 1883.

Derived Protremata with spondylia to which are attached the adductor, diductor, and ventral pedicle muscles. Commonly cruralia are present.

1. Family CLITAMBONITIDÆ Winchell and Schuchert, 1893.

Orthisidæ (partim) d'Orbigny, 1849; Orthisinæ Waagen, 1884.

Primitive Pentameracea with long, straight cardinal areas and a well-developed deltidium. No cruralium.

[1] *Text-book of Paleontology*, by Zittel and Eastman, 1896, p. 320.

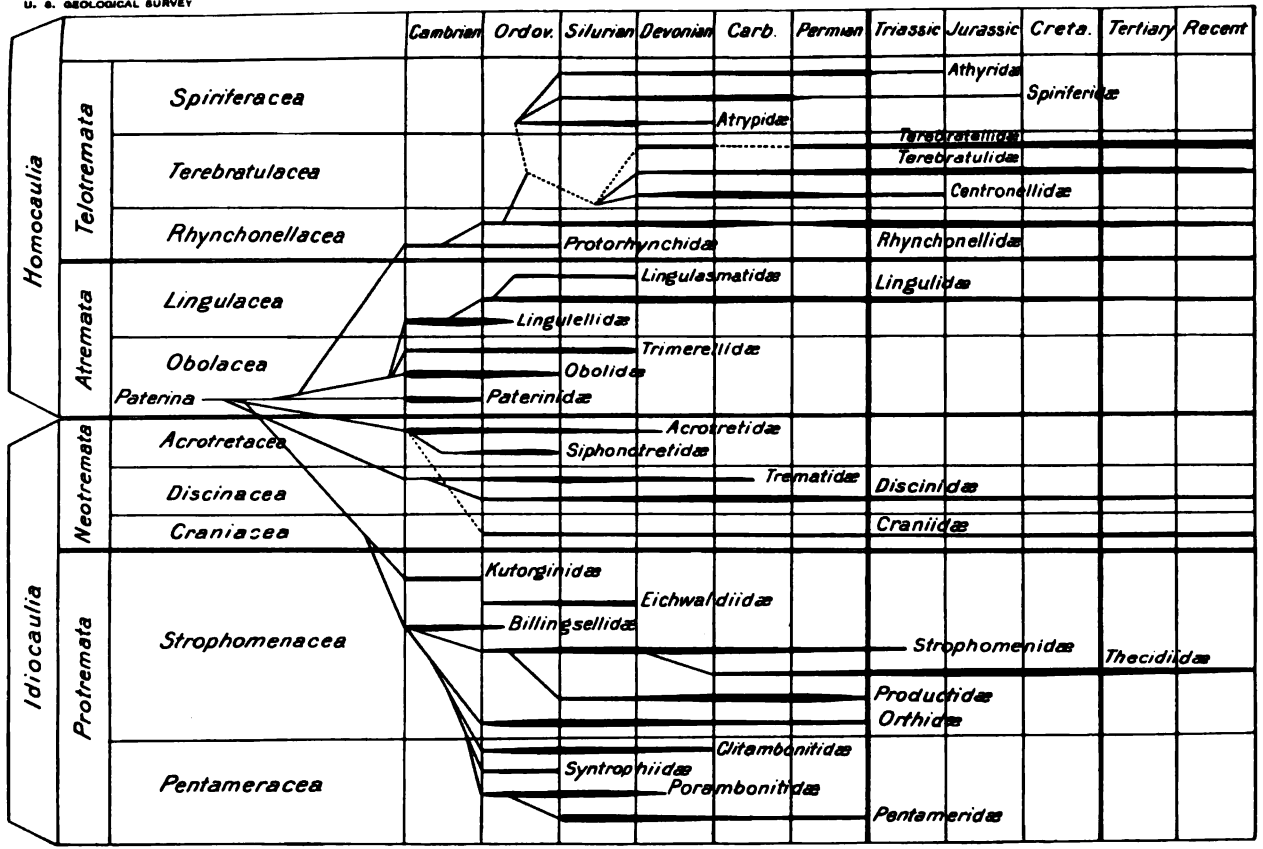

DIAGRAM ILLUSTRATING GEOLOGIC DISTRIBUTION OF FAMILIES.

Clitambonites Pander, 1830.
Pronites Pander, 1830.
Gonambonites Pander, 1830.
Orthisina d'Orbigny, 1847.
Polytœchia Hall and Clarke, 1892.
Hemipronites Pander, 1830.
Scenidium Hall, 1860.
Mystrophora Kayser, 1871.

2. Family SYNTROPHIIDÆ Schuchert, 1896.[1]

Stricklandiniidæ (partim) Hall and Clarke, 1895.

Primitive Pentameracea with long, straight cardinal areas, deltidia, and cruralia.

Syntrophia Hall and Clarke, 1892–93.

2a. Family PORAMBONITIDÆ Davidson, 1853.[2]

Porambonitinæ Gill, 1871; Porambonitidæ (partim) Nœtling, 1883; Camarellidæ (partim) Hall and Clarke, 1895.

Pentameracea intermediate in structure between the Syntrophiidæ and Pentameridæ, in that the deltidium and the straight cardinal areas of the former family tend to obsolescence, particularly the deltidium. The Porambonitidæ approach the latter family in tending to develop a rostrate shell. Cruralium present.

Camarella Billings, 1859 (emend Hall and Clarke, 1893).
Parastrophia Hall and Clarke, 1893.
Anastrophia Hall, 1867.
Brachymerus Shaler, 1865 (not Dejean, 1834).
Branconia Gagel, 1890.
Porambonites Pander, 1830.
Priambonites Agassiz, 1847.
Isorhynchus King, 1850.
Nœtlingia Hall and Clarke, 1893.
†Lycophoria Lahusen, 1885.

2b. Family PENTAMERIDÆ McCoy, 1844.

Hypothyridæ (partim) King, 1850; Pentameridæ Hall, 1867; Camerophoriinæ Waagen, 1883; Pentamerinæ Gill, 1871; Waagen, 1883; Porambonitidæ (partim) Nœtling, 1883; Stenochismatinæ and Conchidiinæ Œhlert, 1887; Camarellidæ (partim), Stricklandiniidæ (partim), and Amphigenidæ Hall and Clarke, 1895.

Rostrate Pentameracea rarely with straight cardinal areas. Deltidium commonly absent, but sometimes present as a concave plate, being the reverse of the ordinary form of the deltidium and due to the incurved beaks. Cruralium present.

Stricklandinia Billings, 1863.
Stricklandia Billings, 1859.
Pentamerus Sowerby, 1813.
Pentastère Blainville, 1824.
Capellinia Hall and Clarke, 1893.
Pentamerella Hall, 1867.
Gypidula Hall, 1867.
Sieberella Œhlert, 1887.
Camarophorella Hall and Clarke, 1893.
Amphigenia Hall, 1867.
Conchidium Linné, 1753.
Antirhynchonella Quenstedt, 1871.
Zdimir Barrande, 1879.
Gypidia Dalman, 1828.
Clorinda Barrande, 1879.
Barrandella Hall and Clarke, 1893.
Enantiosphen Widborne (Holzapfel), 1893.
Camarophoria King, 1846.
Stenochisma Dall, 1877; Œhlert, 1887 (not Conrad, 1839).

[1] Text book of Paleontology, by Zittel and Eastman, 1896, p. 320.

[2] Since Hall and Clarke's family Camarellidæ (1895), after removing Camarophoria and Camarophorella, is based upon the same family characters as those of the Porambonitidæ (1853), as Porambonites is now interpreted, *Davidson's family is* retained on the ground of priority.

Synopsis of the divisions of Brachiopoda higher than genera.

Superorders.	*Orders.*	*Superfamilies.*	*Families.*
Pedicle common to both valves throughout life or only in youthful growth. (Homocaulia.)	Pedicle opening common to both valves throughout life. No deltidial plates. Inarticulate. (Atremata.)	Shells rounded. Pedicle short. Animal not burrowing. (Obolacea.)	Valves semicircular; pedicle opening more or less large = Paterinidæ.
			Valves rounded, posteriorly acuminate; pedicle opening small = Obolidæ.
			Valves round or oval, thick, with solid or excavated platforms = Trimerellidæ.
		Shells elongate. Pedicle long. Animal burrowing. (Lingulacea.)	Shells thin, elongate, with oboloid interiors = Lingulellidæ.
			Shells thin, elongate, with muscular system highly specialized = Lingulidæ.
			Shells elongate, with solid platforms = Lingulasmatidæ.
	Pedicle opening common to both valves only in youthful growth. Deltidial plates usually present. (Telotremata.)	Brachia supported by crura. (Rostracea.)	Shells primitive. No deltidial plates; articulation rudimentary = Protorhynchidæ.
			Articulation and deltidial plates well developed = Rhynchonellidæ.
		Brachia supported by loops. (Terebratulacea.)	Loops free, developing direct; no metamorphoses = Centronellidæ.
			Loops free, developing indirect = Terebratulidæ.
			Loops attached to a median septum; developing indirect = Terebratellidæ.
		Brachia supported by spiralia. (Spiriferacea.)	Crura directly continuous with bases of primary lamellæ between which are the spiralia = Atrypidæ.
			Crura directly continuous with bases of primary lamellæ which are between the spiralia = Spiriferidæ.
			Bases of primary lamellæ between the spiralia, and sharply recurving dorsally at their junction with the crura = Athyridæ.

Synopsis of the divisions of Brachiopoda higher than genera—Continued.

Superorders.	*Orders.*	*Superfamilies.*	*Families.*	
Pedicle restricted to ventral valve throughout or only in youthful growth. (Idiocaulia.)	Pedicle restricted to ventral valve throughout life. Inarticulate. (Neotremata.)	Pedicle aperture modified by a deltidium. (Acrotretacea.)	Pedicle opening small, circular, posterior to protegulum	= Acrotretidæ.
			Pedicle fissure narrow, elongate, anterior to protegulum	= Siphonotretidæ.
		Pedicle slit modified by a listrium. (Discinacea.)	Pedicle fissure marginal, open posteriorly	= Trematidæ.
			Pedicle fissure narrow, elongate, closed posteriorly	= Discinidæ.
		Pedicle suppressed. (Craniacea.)	Shells partially or completely cemented to foreign bodies	= Craniidæ.
	Pedicle restricted to ventral valve throughout or a portion of life. Articulate. (Protremata.)	Shells without spondylia and cruralia. (Strophomenacea.)	Pedicle opening large; deltidium and articulation incipient. No crural process	= Kutorginidæ.
			Rostrate, aberrant Strophomenacea	= Eichwaldiidæ.
			Cardinal areas and deltidium well developed. No cardinal process	= Billingsellidæ.
			Cardinal areas, deltidium, chilidium, and cardinal process well developed	= Strophomenidæ.
			Strophomenidæ with impressed brachial furrows	= Thecidiidæ.
			Valves more or less covered with hollow, anchoring spines	= Productidæ.
			Cone-shaped productoids completely modified by cementation	= Richthofenidæ.
			Delthyrium usually large, open; deltidium developed only in early growth	= Orthidæ.
		Shells with spondylia and cruralia. (Pentameracea.)	Large, straight cardinal areas with prominent deltidium. No cruralia	= Clitambonitidæ.
			Straight cardinal areas, prominent deltidium, and short cruralia	= Syntrophiidæ.
			Shells intermediate in structure between Syntrophiidæ and Pentameridæ	= Porambonitidæ.
			Shells rostrate, commonly without deltidium. Cruralia well developed	= Pentameridæ.

CHAPTER VI.

INDEX AND BIBLIOGRAPHY OF AMERICAN FOSSIL BRACHIOPODA.

ACAMBONA White. Genotype A. prima White.

Acambona White, Proc. Boston Soc. Nat. Hist., IX, 1862, p. 27, figs. 1, 2.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 119;—Thirteenth Ann. Rep. N. Y. State Geologist, 1895, p. 797.

Acambona osagensis (Swallow). Chouteau (L. Carb.).

Retzia osagensis Swallow, Trans. St. Louis Acad. Sci., I, 1860, p. 653.

Acambona? osagensis Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 120, pl. 51, figs. 38, 39.

Retzia? osagensis Keyes, Geol. Survey Missouri, V, 1895, p. 94.

Loc. Cooper and Benton counties, Missouri.

Acambona prima White. Burlington (L. Carb.).

Acambona prima White, Proc. Boston Soc. Nat. Hist., IX, 1862, p. 27, figs. 1, 2.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 119, pl. 51, figs. 40, 41.

Eumetria prima Miller, North American Geol. and Pal., 1889, p. 346.

Loc. Burlington, Iowa.

Obs. It is probable that this species is identical with A. osagensis.

ACROTHELE Linnarsson. Genotype A. coriacea Linnarsson.

Acrothele Linnarsson, Bihang till Kgl. Svenska Vetens.-Akad. Handl., III, 1876, p. 20.—Walcott, Bull. U. S. Geol. Survey, 30, 1886, p. 107.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 98, 167;—Eleventh Ann. Rep. N. Y. State Geologist, 1892, p. 249.

Acrothele bellula Walcott. Middle Cambrian.

Acrothele bellula Walcott, Proc. U. S. National Mus., XIX, 1897, p. 716, pl. 60, figs. 4–4e.

Loc. Cowans Creek, Cherokee County, Alabama.

Acrothele decipiens Walcott. Lower Cambrian.

Acrothele decipiens Walcott, Proc. U. S. National Mus., XIX, 1897, p. 716, pl. 60, fig. 2.

Loc. Near Stoner's, York County, Pennsylvania.

Acrothele (?) dichotoma Walcott. Lower Cambrian.

Acrothele? dichtoma Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 14, pl. 9, fig. 11;—Bull. U. S. Geol. Survey, 30, 1886, p. 107.

Loc. Eureka district, Nevada.

Acrothele matthewi (Hartt). Middle Cambrian.

Lingula matthewi Hartt, Dawson's Acadian Geology, 2d ed., 1868, p. 644, fig. 221;—Ibidem, 3d ed., 1874, p. 644, fig. 221.

Acrothele matthewi Matthew, Trans. Royal Soc. Canada, III, 1886, p. 39, pl. 5, fig. 15.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 99, pl. 3, fig. 29.—Matthew, Trans. N. Y. Acad. Sci., XIV, 1895, p. 128, pl. 5, figs. 6, 7, 8.

Loc. Portland, New Brunswick; Manuels Brook, Conception Bay, Newfoundland.

Acrothele matthewi costata Matthew. ?Middle Cambrian.

Acrothele matthewi var. costata Matthew, Trans. N. Y. Acad. Sci., XIV, 1895, p. 128, pl. 5, fig. 9.

Loc. Hanford Brook, New Brunswick.

Acrothele matthewi lata Matthew. Middle Cambrian.

Acrothele matthewi var. lata Matthew, Trans. Royal Soc. Canada, III, 1886, p. 41, pl. 5, fig. 17.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 3, figs. 26–28.

Loc. Portland, New Brunswick.

Acrothele matthewi prima Matthew. Middle Cambrian.

Acrothele matthewi var. prima Matthew, Trans. Royal Soc. Canada, III, 1886, p. 41, pl. 5, fig. 16.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 3, fig. 25.

Loc. Hanford Brook, New Brunswick.

Acrothele subsidua (White). Lower and Middle Cambrian.

Acrotreta? subsidua White, Wheeler's Geogr. Geol. Expl. and Surv. west 100 Merid., Prelim. Rep., 1874, p. 6;—Ibidem, Final Rep., IV, 1875, p. 34, pl. 1, fig. 3.

Acrothele subsidua White, Proc. U. S. National Mus., III, 1880, p. 47.—Walcott, Bull. U. S. Geol. Survey, 30, 1886, p. 108, pl. 9, fig. 4;—Tenth. Ann. Rep. U. S. Geol. Survey, 1891, p. 608, pl. 70, fig. 1.—Beecher, American Jour. Sci., XLI, 1891, p. 357, pl. 17, fig. 12.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 100, pl. 3, figs. 30, 31.

Loc. Antelope Spring, Utah; Pioche, Nevada.

ACROTRETA Kutorga. Genotype A. subconica Kutorga.

Acrotreta Kutorga, Verhand. Kais. Min. Gessel. zu St. Petersburg, 1848, p. 275.—Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 16.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 101, 166;—Eleventh Ann. Rep. N. Y. State Geologist, 1892, p. 250.

Acrotreta attenuata Meek=A. gemma.

Acrotreta baileyi Matthew. Middle and Upper Cambrian.

Acrotreta baileyi Matthew, Trans. Royal Soc. Canada, III, 1886, p. 36, pl. 5, fig. 13.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 102, pl. 3, figs. 32–34.—Matthew, Trans. Royal Soc. Canada, IX, 1892, p. 43, pl. 12, fig. 7d.

Loc. Hanford Brook and Long Reach, New Brunswick.

Acrotreta gemma Billings. Lower to Upper Cambrian.

Acrotreta gemma Billings, Pal. Fossils, I, 1865, p. 216, fig. 201.—Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 17, pl. 1, fig. 1; pl. 9, fig. 9;—Bull. U. S. Geol. Survey, 30, 1886, p. 98, pl. 8, fig. 1;—Tenth Ann. Rep. U. S. Geol. Survey, 1891, p. 608, pl. 67, fig. 5.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 102, figs. 55–57.—Matthew, Trans. N. Y. Acad. Sci., XIV, 1895, p. 126.

Acrotreta subconica Meek, Hayden's Sixth Ann. Rep. U. S. Geol. Survey Terr., 1873, p. 463.

Acrotreta attenuata Meek, Ibidem, 1873, p. 463.

Acrotreta pyxidicula White, Wheeler's Geogr. Geol. Expl. and Survey west 100 Merid., Prelim. Rep., 1874, p. 9;—Ibidem, Final Rep., IV, 1875, p. 53, pl. 3, fig. 3.

Loc. Near Portland Creek, Newfoundland; Eureka and White Pine mining districts, Nevada.

Acrotreta gemma depressa Walcott. Middle Cambrian.

Acrotreta gemma var. depressa Walcott, Proc. U. S. National Mus., XI, 1888, p. 441.

Loc. Mount Stephen, British Columbia.

Acrotreta gemmula Matthew. Middle Cambrian.

Acrotreta gemmula Matthew, Trans. Royal Soc. Canada, X, 1894, p. 87, pl. 16, fig. 2;—Trans. N. Y. Acad. Sci., XIV, 1895, p. 126, pl. 5, fig. 5.

Loc. St. Martins, New Brunswick.

Acrotreta gulielmi Matthew=Discinopsis gulielmi.

Acrotreta microscopica (Shumard). Middle Cambrian.

Discina microscopica Shumard, American Jour. Sci., XXXII, 2d ser., 1861, p. 221.

Loc. Occurs abundantly in Burnett and Llano counties, Texas.

Acrotreta pyxidicula White=Acrotreta gemma.

Acrotreta subconica Meek (non Kutorga)=Acrotreta gemma.

Acrotreta (?) subsidua White=Acrothele subsidua.

Ægilops Hall. A genus of pelecypods.

AMBOCŒLIA Hall. Genotype Orthis umbonata Conrad.

Ambocœlia Hall, Thirteenth Rep. N. Y. State Cab. Nat. Hist., 1860, p. 71, figs. 1–3; p. 72, figs. 4–6.—Meek and Hayden, Pal. Upper Missouri, Smithsonian Cont. to Knowl., 172, 1864, p. 20.—Hall, Pal. New York, IV, 1867, p. 258—Davidson, Suppl. British Sil. Brach., Palæontographical Soc., 1882, p. 131.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 85.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 54;—Thirteenth Ann. Rep. N. Y. State Geologist, 1895, p. 761.

Ambocœlia fimbriata Claypole. Portage (Dev.).

Ambocœlia fimbriata Claypole, Proc. American Phil. Soc., XXI, 1883, p. 232.

Loc. Perry County, Pennsylvania.

Ambocœlia gemmula McChesney=Ambocœlia planoconvexa.

Ambocœlia gregaria Hall. Chemung (Dev.).

Orthis unguiculus Hall (non Phillips), Geol. New York; Rep. Fourth Dist., 1843, p. 267, fig. 5.

Ambocœlia gregaria Hall, Thirteenth Rep. N. Y. State Cab. Nat. Hist., 1860, p. 81;—Fifteenth Rep. Ibidem, 1862, p. 186.—Williams, Bull. U. S. Geol. Survey, 3, 1884, p. 11.

Ambocœlia umbonata var. gregaria Hall, Pal. New York, IV, 1867, p. 261, pl. 44, figs. 19–25.

Loc. New York; Pennsylvania, and Virginia.

Obs. See Martinia subumbona.

Ambocœlia minuta White. Kinderhook (L. Carb.).

Ambocœlia (Spirifer?) minuta White, Proc. Boston Soc. Nat. Hist., IX, 1862, p. 26.

Loc. Hamburg, Illinois, and Hannibal, Missouri.

Ambocœlia planoconvexa (Shumard). Upper Carboniferous.

Spirifer planoconvexa Shumard, Geol. Rep. Missouri, 1855, p. 202.—Geinitz, Carbon u. Dyas in Nebraska, 1866, p. 42, pl. 3, figs. 10–18.

Ambocœlia gemmula McChesney, New Pal. Fossils, 1860, p. 41;—Ibidem, 1865, pl. 1, fig. 3.

Spirifer (Martinia) planoconvexa Meek and Hayden, Pal. Upper Missouri, Smithsonian Cont. to Knowl., 172, Pt. I, 1864, p. 20, figs. a–e.—Meek, Final Rep. U. S. Geol. Survey Nebraska, 1872, p. 184, pl. 4, fig. 4; pl. 8, fig. 2.

Martinia planoconvexa McChesney, Trans. Chicago Acad. Sci., I, 1868, p. 34, pl. 1, fig. 3.

Ambocœlia planoconvexa (Shumard)—Continued.

Spirifera (Martinia) planoconvexa Derby, Bull. Cornell Univ., I, 1874, p. 19, pl. 8, figs. 12, 16, 18; pl. 9, fig. 7.—White, Wheeler's Geogr. Geol. Expl. and Survey west 100 Merid., IV, 1875, p. 135, pl. 10, fig. 3;—Thirteenth Rep. Indiana State Geol., 1884, p. 134, pl. 32, figs. 23, 24.—Herrick, Bull. Denison Univ., II, 1887, p. 46, pl. 1, fig. 12.—Keyes, Geol. Survey Missouri, V, 1895, p. 85.

Ambocœlia planoconvexa Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 56, pl. 39, figs. 10–15.

Loc. Missouri; Iowa; Illinois; Ohio; Indiana; Kansas; Nebraska; New Mexico; Elko Mountain, Nevada; Bomjardim and Itaituba, Brazil.

Ambocœlia præumbona Hall. Hamilton (Dev.).

Orthis præumbona Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 167.

Ambocœlia præumbona Hall, Thirteenth Rep. Ibidem, 1860, p. 71;—Pal. New York, IV, 1867, p. 262, pl. 44, figs. 1–6.

Loc. Seneca, Cayuga, and Canandaigua lakes, New York.

Ambocœlia spinosa Hall and Clarke. Hamilton (Dev.).

Ambocœlia spinosa Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pp. 56, 363, pl. 39, figs. 16–18.—Clarke, Thirteenth Ann. Rep. N. Y. State Geologist, 1895, p. 177, pl. 4, figs. 6–8.

Loc. Livingston County, New York.

Ambocœlia subumbona Hall=Martinia subumbona.

Ambocœlia umbonata (Conrad). Marcellus–Chemung (Dev.).

Orthis umbonata Conrad, Jour. Acad. Nat. Sci. Philadelphia, VIII, 1842, p. 264, pl. 14, fig. 4.—Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 167, figs. 1–3.

Orthis nucleus Hall, Geol. New York; Rep. Fourth Dist., 1843, p. 180, fig. 8.

Ambocœlia umbonata Hall, Thirteenth Rep. N. Y. State Cab. Nat. Hist., 1860, p. 71;—Pal. New York, IV, 1867, p. 259, pl. 44, figs. 7–18.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 86, pl. 17, figs. 25, 26.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pl. 29, fig. 17; pl. 39, figs. 4–9.

Martinia umbonata Herrick, Geol. Ohio, VII, 1895, pl. 20, fig. 3.

Loc. New York; Pennsylvania; Falls of Ohio.

Ambocœlia umbonata gregaria Hall=Ambocœlia gregaria.

AMPHIGENIA Hall. Genotype Pentamerus elongatus Vanuxem.

Amphigenia Hall, Twentieth Rep. N. Y. State Cab. Nat. Hist., 1867, p. 163;—Pal. New York, IV, 1867, pp. 374, 382.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 252;—Thirteenth Ann. Rep. N. Y. State Geologist, 1895, p. 848.

Amphigenia curta (Meek and Worthen). Oriskany (Dev.).

Stricklandinia elongata var. curta Meek and Worthen, Geol. Survey Illinois, III, 1868, p. 402, pl. 8, fig. 1; pl. 9, fig. 5.—? Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 254.

Loc. Union County, Illinois.

Amphigenia elongata (Vanuxem). Oriskany and Up. Helderberg (Dev.).

Pentamerus elongatus Vanuxem, Geol. N. Y.; Rep. Third Dist., 1842, p. 132, fig. 1.—Hall, Geol. N. Y.; Rep. Fourth Dist., 1843, Tables of Organic Remains.

Meganteris elongatus Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 123, figs. 1, 2.

Rensselæria elongata Hall, Twelfth Rep. Ibidem, 1859, p. 38;—Pal. New York, III, 1859, p. 453.

Stricklandia elongata Billings, Canadian Jour., VI, 1861, p. 267, figs. 91, 92.

Amphigenia elongata (Vanuxem)—Continued.

Stricklandinia elongata Billings, Geol. Canada, 1863, p. 371, fig. 390.

Amphigenia elongata Hall, Pal. New York, IV, 1867, p. 383, pl. 58A, figs. 21–24; pl. 59, figs. 1–11.—Billings, Canadian Nat. Geol., n. ser., VII., 1874, p. 240.—Rathbun, Proc. Boston Soc. Nat. Hist., XX, 1879, p. 34.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 253, pl. 73, figs. 16–20; pl. 74, figs. 1–9; pl. 76, fig. 9.

Loc. New York; Michigan; Cayuga, Ontario; Rio Maecuru and Rio Curua, Brazil.

Amphigenia elongata subtrigonalis Hall. Up. Helderberg (Dev.).

Meganteris subtrigonalis Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 123.

Amphigenia elongata var. subtrigonalis Hall, Pal. New York, IV, 1867, p. 384.

Loc. Erie County, New York.

Amphigenia elongata undulata Hall. Up. Helderberg (Dev.).

Amphigenia elongata var. undulata Hall, Pal. New York, IV, 1867, p. 384, pl. 58A, figs. 25–27.

Loc. Mackinac, Michigan.

AMPHISTROPHIA Hall and Clarke. Genotype Strophonella striata Hall.

Amphistrophia Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 292;—Eleventh Ann. Rep. N. Y. State Geologist, 1894, p. 283.

Obs. Proposed as a subgenus of Strophonella.

ANABAIA Clarke. Genotype A. paraia Clarke.

Anabaia Clarke, Pal. New York, VIII, Pt. II, 1893, p. 141.—Hall and Clarke, Thirteenth Ann. Rep. N. Y. State Geologist, 1895, p. 805.

Anabaia paraia Clarke. Silurian.

Anabaia paraia Clarke, Pal. New York, VIII, Pt. II, 1893, p. 141, figs. 124–127.

Loc. Rio Trombetas, Province of Para, Brazil.

ANASTROPHIA Hall. Genotype Pentamerus verneuili Hall.

Brachymerus Shaler (non Dej., 1834), Bull. Mus. Comp. Zool., 4, 1865, p. 69.

Anastrophia Hall, Twentieth Rep. N. Y. State Cab. Nat. Hist., 1867, p. 163;—Pal. New York, IV, 1867, p. 374.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 47.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 224;—Thirteenth Ann. Rep. N. Y. State Geologist, 1895, p. 839.

Anastrophia brevirostris (Sowerby?) Hall. Niagara (Sil.).

Terebratula brevirostris Sowerby, Murchison's Sil. System, 1839, p. 631, pl. 13, fig. 15.

Atrypa brevirostris? Hall, Pal. New York, II, 1852, p. 278, pl. 58, fig. 1.

Pentamerus brevirostris Hall, Twelfth Rep. N. Y. State Cab. Nat. Hist., 1859, p. 77.

Rhynchonella brevirostris Billings, Geol. Canada, 1863, p. 315, fig. 324.

Loc. Lockport, New York.

Obs. Compare with Anastrophia interplicata. If a pentameroid, this species is probably identical with Anastrophia interplicata Hall.

Anastrophia hemiplicata W. and S. = Parastrophia hemiplicata.

Anastrophia internascens Hall. Niagara (Sil.).

Anastrophia verneuili Hall (non Hall, 1859), Twenty-eighth Rep. N. Y. State Mus. Nat. Hist., Doc. ed., 1876, pl. 26, figs. 41–49.

Anastrophia internascens Hall, Ibidem, 1879, p. 168, pl. 26, figs. 41–49;—Eleventh Rep. State Geol. Indiana, 1882, p. 311, pl. 26, figs. 41–49.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 47, pl. 32, figs. 17–20.—Beecher and Clarke, Mem. N. Y. State Mus., 1, 1889, p. 32, pl. 3, figs. 14–16.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 224, pl. 63, fig. 30.

Loc. Waldron, Indiana; Louisville, Kentucky; Milwaukee, Wisconsin.

Anastrophia interplicata (Hall). Niagara (Sil.).

Atrypa interplicata Hall, Pal. New York, II, 1852, p. 275, pl. 57, fig. 2.

Pentamerus interplicatus Hall, Twelfth Rep. N. Y. State Cab. Nat. Hist., 1859, p. 77.

Anastrophia interplicata Miller, American Pal. Fossils, 1877, p. 104.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 224.

Loc. Lockport, New York; Louisville, Kentucky; Wisconsin.

Obs. See A. breyirostris.

Anastrophia reversa Miller=Parastrophia reversa.

Anastrophia scofieldi W. and S.=Parastrophia scofieldi.

Anastrophia verneuili Hall, 1876 (non 1859)=Anastrophia internascens.

Anastrophia verneuili (Hall). Lower Helderberg (Dev.).

Atrypa lacunosa Vanuxem (non Sowerby), Geol. N. Y.; Rep. Third Dist., 1842, p. 117, fig. 3, and p. 119.

Pentamerus verneuili Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 104, figs. 1, 2;—Pal. New York, III, 1859, p. 260, pl. 48, fig. 1.—Billings, Geol. Canada, 1863, p. 957, fig. 453.

Anastrophia verneuili Miller, N. American Geol. Pal., 1889, p. 334.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 224, pl. 63, figs. 31–38; pl. 84, figs. 43, 44.

Loc. Eastern New York; Perry County, Tennessee; Petermann Fiord, Greenland.

Anazyga recurvirostra Davidson=Zygospira recurvirostris.

ANOPLIA Hall and Clarke. Genotype Leptæna nucleata Hall.

Anoplia Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 309;—Eleventh Ann. Rep. N. Y. State Geologist, 1894, p. 293.

Anoplia nucleata Hall. Oriskany and Corniferous (Dev.).

Leptæna nucleata Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 47.

Leptæna? nucleata Hall, Pal. New York, III, 1859, p. 419, pl. 94, fig. 1.—Meek and Worthen, Geol. Survey Illinois, III, 1868, p. 393, pl. 8, fig. 8.

Anoplia nucleata Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 309, pl. 15A, figs. 17, 18; pl. 20, figs. 14–17.

Loc. Albany County, New York; Alexander County, Illinois; Cayuga, Ontario.

Obs. It is probable that Productella nucleata Nicholson is a synonym of this species.

ANOPLOTHECA Sandberger (emend Hall and Clarke). Genotype Productus lamellosus Sandberger=Terebratula venusta Schnur.

Anoplotheca F. Sandberger, Sitzb. d. k. k. Akad. d. Wissens., math -naturw. Classe, XVI, 1853, p. 5; XVIII, p. 102.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 129, figs. 113–121.

Leptocœlia Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 108;—Twelfth Rep., Ibidem, 1859, p. 32, figs. 1, 2, 4;—Pal. New York, III, 1859, p. 447.—Billings, Canadian Jour., VI, 1861, p. 351.—Hall, American Jour. Sci., XXXVI, 1863, p. 14.—Rominger, American Jour. Sci., XXXV, 1863, p. 84.—Hall, Pal. New York, IV, 1867, p. 365.—Dall, American Jour. Conch., VII, 1871, p. 60.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 151.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 136.

Cœlospira Hall, Sixteenth Rep. N. Y. State Cab. Nat. Hist., 1863, p. 59;—Trans. Albany Institute, IV, 1863, p. 146;—Pal. New York, IV, 1867, p. 328.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 134, figs. 122, 123.

Bifida Davidson, Supplement to British Dev. Brach., Palæontographical Soc., 1882, p. 27.

Anoplotheca, Cœlospira, and Leptocœlia Hall and Clarke, Thirteenth Ann. Rep. N. Y. State Geologist, 1895, pp. 801–803.

ANOPLOTHECA Sandberger (emend Hall)—Continued.

Obs. Hall and Clarke have shown that Anoplotheca and Bifida are synonymous terms and that Cœlospira is also structurally identical. The latter name, however, they retain as a subgenus of Anoplotheca. While the brachydium is not yet fully known in Leptocœlia, all its other characters are the same as those of Cœlospira. Under these circumstances it appears best, for the present at least, to refer all American species of Leptocœlia and Cœlospira to Anoplotheca.

Anoplotheca acutiplicata (Conrad). Corniferous (Dev.).

Atrypa acutiplicata Conrad, Fifth Ann. Rep. N. Y. Geol. Survey, 1841, p. 54.—Hall, Fifteenth Rep. N. Y. State Cab. Nat. Hist., 1862, pl. 11, fig. 17.

Leptocœlia acutiplicata Hall, Pal. New York, IV, 1867, p. 365, pl. 67, figs. 30–39.

Cœlospira acutiplicata Hall and Clarke, Ibidem, VIII, Pt. II, 1893, p. 136, pl. 53, figs. 32–39.

Loc. Waterville, Cassville, East Victor, etc., New York.

Anoplotheca camilla (Hall). Oriskany and Up. Helderberg (Dev.).

Cœlospira concava Hall (non Hall 1863), Pal. New York, IV, 1867, p. 329.

Cœlospira camilla Hall, Ibidem, 1867, pl. 52, figs. 13–19;—Twentieth Rep. N. Y. State Cab. Nat. Hist., 1867, p. 168.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 136, pl. 53, figs. 24–31.

Loc. Caledonia, New York; county of Haldimand, Ontario.

Anoplotheca concava (Hall). Lower Helderberg (Dev.).

Leptocœlia concava Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 107;—Pal. New York, III, 1859, p. 245, pl. 38, figs. 1–7.—Billings, Canadian Jour., VI, 1861, p. 352, fig. 127;—Geology Canada, 1863, p. 369, fig. 383; p. 957, fig. 451.

Cœlospira concava Hall, Sixteenth Rep. N. Y. State Cab. Nat. Hist., 1863, p. 60;—Trans. Albany Institute, IV, 1863, p. 146.—Meek, American Jour. Sci., 2d ser., XL, 1865, p. 33.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 134, figs. 122, 123; pl. 53, figs. 20–23.

Loc. Albany and Schoharie counties, New York; Kennedy Channel, Arctic region.

Anoplotheca dichotoma (Hall). Oriskany (Dev.).

Leptocœlia dichotoma Hall, Pal. New York, III, 1859, p. 452, pl. 103B, figs. 3.—Hall and Clarke, Ibidem, VIII, Pt. II, 1893, p. 137.

Loc. Cumberland, Maryland.

Obs. Possibly the young of Anoplotheca flabellites.

Anoplotheca fimbriata (Hall). Oriskany (Dev.).

Leptocœlia fimbriata Hall, Twelfth Rep. N. Y. State Cab. Nat. Hist., 1859, p. 33, fig. 3;—Pal. New York, III, 1859, p. 450, pl. 103B, fig. 2.—Hall and Clarke, Ibidem, VIII, Pt. II, 1893, p. 137, pl. 53, figs. 47–52, 54, 55.

Loc. Cumberland, Maryland.

Anoplotheca flabellites (Conrad). Oriskany and Corniferous (Dev.).

Atrypa flabellites Conrad, Fifth Ann. Rep. N. Y. Geol. Survey, 1841, p. 55.

Atrypa palmata Morris and Sharpe, Quart. Jour. Geol. Soc. London, II, 1846, p. 276, pl. 10, fig. 5.

Orthis palmata Sharpe and Salter, Trans. Geol. Soc. London, 2d ser., VII, 1856, p. 207, pl. 26, figs. 7–10.

Leptocœlia propria Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 108.

Leptocœlia flabellites Hall, Twelfth Rep. Ibidem, 1859, p. 33, figs. 1, 2, 4;—Pal. New York, III, 1859, p. 449, pl. 103B, fig. 1; pl. 106, fig. 1.—Billings, Canadian Jour., VI, 1861, p. 351, fig. 126;—Geology Canada, 1863, p. 369, fig. 382.—Meek and Worthen, Geol. Survey Illinois, III, 1868, p. 397, pl. 8, fig. 3.—Billings, Pal. Fossils, II, 1874, p. 42, pl. 3, figs. 5, 6.—Steinmann, American Naturalist, XXV, 1891, p. 856.—A. Ulrich, N. Jahrb. f. Mineral., Beilageband,

Anoplotheca flabellites (Conrad)—Continued.

VIII, 1892, p. 60, pl. 4, figs. 9, 10–13.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 137, pl. 53, figs. 40–46, 53.—Von Ammon, Zeits. Gesells. für Erdk., Berlin, XXVIII, 1893, p. 363, fig. 7.

Orthis aymara Salter, Quart. Jour. Geol. Soc. London, XVII, 1861, p. 68, pl. 4, fig. 14.

Orthis palmata Sharpe and Salter, Trans. Geol. Soc. London, 2d ser., VII, 1856, p. 207, pl. 26, figs. 7–10.

Loc. Schoharie, etc., New York; county of Haldimand, Ontario; Gaspé; Cumberland, Maryland; Union County, Illinois; Bolivia; Tanquarassu, Matto Grosso, Brazil; Falkland Islands; South Africa.

Anoplotheca hemispherica (Sowerby). Clinton (Sil.).

Atrypa hemispherica Sowerby, Murchison's Silurian System, 1839, p. 639, pl. 20, fig. 7.—Hall, Pal. New York, II, 1852, p. 74, pl. 23, fig. 10.—Billings, Geology Canada, 1863, p. 318, fig. 337.

Atrypa hemispherica? Hall, Geology, N. Y.; Rep. Fourth Dist., 1843, p. 73, fig. 4.

Leptocœlia hemispherica Hall, Twelfth Rep. N. Y. State Cab. Nat. Hist., 1859, p. 77.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 152, pl. 32, figs. 21–23, 36–39.—Foerste, Proc. Boston Soc. Nat. Hist., XXIV, 1890, p. 325, pl. 6, figs. 18, 19.

Atrypa flabella Shaler, Bull. Mus. Comp. Zool., 4, 1865, p. 68.

Cœlospira? hemispherica Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 136, pl. 82, figs. 1–4 (? pl. 52, fig. 16).

Loc. England; Rochester, Sodus, and Walcott, New York; Louisville, Kentucky; Cumberland Gap, Tennessee; Ringgold, Georgia; Collinsville, Alabama; Arisaig, Nova Scotia (Ami); Anticosti.

Anoplotheca infrequens (Walcott). Lower and Upper Devonian.

Trematospira infrequens Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 151, pl. 4, fig. 3.

Loc. Lone Mountain, Nevada.

Obs. The exterior is like that of A. flabellites.

Anoplotheca planoconvexa (Hall). Clinton (Sil.).

Atrypa planoconvexa Hall, Pal. New York, II, 1852, p. 75, pl. 23, fig. 11.—Billings, Geology Canada, 1863, p. 318, fig. 336.

Leptocœlia planoconvexa Hall, Twelfth Rep. N. Y. State Cab. Nat. Hist., 1859, p. 78.—Nicholson and Hinde, Canadian Jour., n. ser., XIV, 1874, p. 144.

Cœlospira ?planoconvexa Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 136, pl. 52, fig. 15; pl. 53, figs. 11–16.

Loc. Flamborough Head, Ontario; Niagara of Wisconsin (Whitfield).

Anoplotheca plicatula (Hall). Clinton (Sil.).

Atrypa plicatula Hall, Geol. N. Y.; Rep. Fourth Dist., 1843, p. 71, fig. 4;—Pal. New York, II, 1852, p. 74, pl. 23, fig. 9.

Leptocœlia? plicatula Hall, Twelfth Rep. N. Y. State Cab. Nat. Hist., 1859, p. 78.

Rhynchonella plicata Miller, N. American Geol. Pal., 1889, p. 369.

Cœlospira? plicatula Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 136, pl. 52, figs. 12–14; pl. 82, fig. 5.

Loc. Reynales Basin, New York; Niagara of Wisconsin (Whitfield).

ATHYRIS McCoy (emend Hall and Clarke).

Genotype Terebratula concentrica von Buch.

Athyris McCoy, Carb. Fossils Ireland, 1844, pp. 128, 146.—Hall, Thirteenth Rep. N. Y. State Cab. Nat. Hist., 1860, p. 73.—Billings, Canadian Jour., V, 1860,

ATHYRIS McCoy (emend Hall and Clarke)—Continued.

p. 273;—Ibidem, VI, 1861, p. 138;—Pal. Fossils, I, 1862, p. 144.—Hall, Twentieth Rep. N. Y. State Cab. Nat. Hist., 1867, pp. 152, 258;—Pal. New York, IV, 1867, p. 282.—Billings, American Jour. Sci., XLIV, 1867, p. 48.—Herrick, Bull. Denison Univ., IV, 1888, p. 14.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 87.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 83, fig. 57 on p. 86;—Thirteenth Ann. Rep. N. Y. State Geologist, 1895, p. 777.

Spirigera d'Orbigny, Paris Acad. Sci., Comptes Rendus, XXV, 1847, p. 268.

Euthyris Quenstedt, Petrefactenkunde Deutschlands, 1871, p. 442.

Athyris americana Swallow=Cleiothyris roissyi.

Athyris angelica Hall. Chemung (Dev.).

Athyris angelica Hall, Fourteenth Rep. N. Y. State Cab. Nat. Hist., 1861, p. 99;—Fifteenth Rep. Ibidem, 1862, pl. 3, figs. 10–13, 24;—Pal. New York, IV, 1867, p. 292, pl. 47, figs. 9–20.—Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 148.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 90, pl. 45, figs. 26–30.

Loc. Phillipsburg, Rockville, etc., New York; Meadville, Pennsylvania; Eureka district, Nevada.

Athyris angelica occidentalis Whiteaves. Hamilton (Dev.).

Athyris angelica occidentalis Whiteaves, Cont. Canadian Pal., I, 1891, p. 227, pl. 32, fig. 3.

Loc. Athabasca River, Canada.

Athyris ashlandensis Herrick=A. lamellosa.

Athyris biloba (A. Winchell). Kinderhook (L. Carb.).

Spirigera biloba A. Winchell, Proc. Acad. Nat. Sci. Philadelphia, 1865, p. 118.

Loc. Rockford, Indiana.

Obs. This species is not well established and is based upon a single ventral valve.

Athyris blancha Billings=Meristella blancha.

Athyris borealis Billings=Catazyga erratica.

Athyris brittsi Miller. Middle Devonian.

Athyris brittsi Miller, Eighteenth Ann. Rep. Geol. Survey Indiana, 1894, p. 314, pl. 9, figs. 16–18.

Loc. Near Otterville, Missouri.

Obs. Probably the same as A. spiriferoides.

Athyris caputserpentis Swallow=Seminula caputserpentis.

Athyris charitonensis Swallow=Seminula charitonensis.

Athyris chloe Billings=Parazyga hirsuta.

Athyris clara Billings=Meristella nasuta.

Athyris claytoni Swallow=Seminula claytoni.

Athyris clintonensis Swallow=Cleiothyris clintonensis.

Athyris clusia Billings=Meristella clusia.

Athyris concentrica Billings (non von Buch)=A. spiriferoides.

Athyris congesta Conrad=Hyatella congesta.

Athyris cora Hall. Hamilton and Chemung ? (Dev.).

Athyris cora Hall, Thirteenth Rep. N. Y. State Cab. Nat. Hist., 1860, p. 94;—Fifteenth Rep. Ibidem, 1862, pl. 3, figs. 15, 16;—Pal. New York, IV, 1867, p. 291, pl. 47, figs. 1–7.—Hall and Clarke, Ibidem, VIII, Pt. II, 1893, p. 90, pl. 45, figs. 6–10.

Loc. Delphi, New York.

Athyris (?) corpulenta (A. Winchell). Kinderhook (L. Carb.).

Spirigera corpulenta A. Winchell, Proc. Acad. Nat. Sci. Philadelphia, 1863, p. 6.

Loc. Burlington, Iowa.

Athyris crassicardinalis White=Cleiothyris crassicardinalis.

Athyris crassirostra Billings=Whitfieldella cylindrica.

Athyris cylindrica Billings=Whitfieldella cylindrica.

Athyris densa Hall and Clarke. St. Louis (L. Carb.).

Athyris densa Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, p. 364, pl. 46, figs. 6–12.

Loc. Washington County, Indiana; Colesburg, Kentucky.

Obs. Compare with Centronella (?) crassicardinalis.

Athyris differentis McChesney=Seminula argentea.

Athyris eborea A. Winchell=A. vittata.

Athyris euzona Swallow=Seminula formosa.

Athyris(?) formosa Swallow=Seminula formosa.

Athyris fultonensis (Swallow). Corniferous and Hamilton (Dev.).

Spirigera fultonensis Swallow, Trans. St. Louis Acad. Sci., I, July or August, 1860, p. 650.

Spirigera minima Swallow, Ibidem, 1860, p. 649.

Athyris vittata Hall, Thirteenth Rep. N. Y. State Cab. Nat. Hist., 1860, p. 89;—Pal. New York, IV, 1867, p. 289, pl. 46, figs. 1–4.—White, Second Ann. Rep. Indiana Bureau of Statistics and Geol., 1880, p. 502, pl. 4, figs. 8, 9;—Tenth Rep. State Geol. Indiana, 1881, p. 134, pl. 4, figs. 8, 9.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 87, pl. 16, figs. 25–32.—Whiteaves, Cont. Canadian Pal., I, 1892, p. 228.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 90, figs. 62, 63; pl. 45, figs. 1–5.—Keyes, Geol. Survey Missouri, V, 1895, p. 90, pl. 41, fig. 1.

Spirigera eborea A. Winchell, Rep. Lower Peninsula Michigan, 1866, p. 94.

Loc. Callaway County, Missouri; Iowa City and New Buffalo, Iowa; Falls of Ohio; Alpena, Michigan; Lake Winnipegosis, Manitoba.

Obs. Specimens of S. fultonensis Swallow and S. eborea Winchell in the writer's collection prove to be the same as A. vittata Hall.

Athyris hannibalensis (Swallow). Chouteau (L. Carb.).

Spirigera hannibalensis Swallow, Trans. St. Louis Acad. Sci., I, 1860, p. 649.

Athyris hannibalensis Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 90, pl. 46, figs. 13–15.—Keyes, Geol. Survey Missouri, V, 1895, p. 90, pl. 40, fig. 9.

Loc. Clarksville, Hannibal, etc., Missouri; Sciotoville, Ohio.

Obs. Meek was inclined to regard this species the same as A. lamellosa. It is, however, distinct. See A. missouriensis.

Athyris harpalyce Billings=Whitfieldella harpalyce.

Athyris hawni Swallow=Seminula hawni.

Athyris headi Billings=Catazyga headi.

Athyris headi anticostiensis Billings=Catazyga erratica.

Athyris headi borealis Billings=Catazyga erratica.

Athyris hirsuta Hall=Cleiothyris hirsuta.

Athyris incrassata Hall. Burlington (L. Carb.).

Athyris incrassata Hall, Geol. Survey Iowa, I, Pt. II, 1858, p. 600, pl. 12, fig. 6.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 90, pl. 46, fig. 21; pl. 83, fig. 39.

Athyris incrassatus Keyes, Geol. Survey Missouri, V, 1895, p. 91, pl. 41, fig. 10.

Loc. Burlington, Iowa; Quincy, Illinois; Hannibal, Missouri.

Athyris intermedia Nicholson=Whitfieldella intermedia.

Athyris intervarica McChesney. Burlington (L. Carb.).
Athyris intervarica McChesney, Descriptions New Pal. Foss., 1861, p. 78.
Loc. Burlington, Iowa.
Obs. May be the same as A. lamellosa L'Eveillé.

Athyris (?) jacksoni (Swallow). Upper Coal Measures.
Spirigera jacksoni Swallow, Trans. St. Louis Acad. Sci., I, 1860, p. 651.
Loc. Cass County, Missouri.

Athyris julia Billings=Whitfieldella julia.
Athyris junia Billings=Hyattella junia.

Athyris lamellosa (L'Eveillé). Waverly-Keokuk (L. Carb.).
Spirifer lamellosus L'Eveillé, Mém. Soc. Géol. de France, II, 1835, p. 39, figs. 21–23.
Athyris lamellosa Meek, Pal. Ohio, II, 1875, p. 283, pl. 14, fig. 6.—Herrick, Bull Denison Univ., III, 1888, p. 49, pl. 2, fig. 7.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 90, pl. 46, figs. 16–20.
Athyris ashlandensis Herrick, Bull. Denison Univ., IV, 1888, p. 24, pl. 3, fig. 6;—Geol. Ohio, VII, 1895, pl. 23, fig. 10.
Loc. Europe; Sciotoville, and Licking County, Ohio; Lebanon, Kentucky; Crawfordsville, Indiana; New Mexico.
Obs. See A. intervarica McChesney.

Athyris lara Billings=Atrypa lara.
Athyris maconensis Swallow=Seminula maconensis.
Athyris maia Billings=Martinia maia.
Athyris minima Swallow=A. fultonensis.

Athyris minutissima Webster. Chemung (Dev.).
Athyris minutissima Webster, American Nat., XXII, 1888, p. 1015.
Loc. Near Rockford, Iowa.

Athyris missouriensis Swallow=Cleiothyris missouriensis.

Athyris missouriensis (A. Winchell). Chouteau (L. Carb.).
Spirigera missouriensis A. Winchell, Proc. Acad. Nat. Sci. Philadelphia, 1865, p. 117.
Loc. Louisiana, Missouri; Medina County, Ohio.
Obs. Should be compared with A. hannibalensis.

Athyris monticola (White). Lower Carboniferous.
Spirigera monticola White, Wheeler's Geogr. Geol. Expl. and Survey west 100 Merid., Prel. Rep., 1874, p. 16;—Final Rep. Ibidem, IV, 1875, p. 91, pl. 5, fig. 11.
Loc. Mountain Spring, Nevada.

Athyris naviformis Billings=Whitfieldella naviformis.
Athyris nitida Billings=Whitfieldella nitida.
Athyris obmaxima McChesney=Cleiothyris obmaxima.
Athyris obvia McChesney=Cleiothyris obvia.

Athyris ohioensis (A. Winchell). Waverly (L. Carb.).
Spirigera ohioensis A. Winchell, Proc. Acad. Nat. Sci. Philadelphia, 1865, p. 118.
Athyris ohioensis Herrick, Bull. Denison Univ., III, 1888, p. 49, pl. 2, fig. 1.
Loc. Akron and Sciotoville, Ohio.

Athyris orbicularis McChesney=Cleiothyris orbicularis.

Athyris (?) ottervillensis Miller. Middle Devonian.

Athyris ottervillensis Miller, Eighteenth Ann. Rep. Geol. Survey Indiana, 1894, p. 314, pl. 9, figs. 14, 15.

Loc. Near Otterville, Missouri.

Athyris papilioniformis McChesney. Kaskaskia (L. Carb.).

Athyris spiriferoides McChesney (non Eaton, 1831), Descriptions New Pal. Foss., 1860, p. 46.

Athyris? papilioniformis McChesney, Ibidem, 1865, pl. 6, fig. 4;—Trans. Chicago Acad. Sci., I, 1868, p. 33, pl. 6, fig. 4.

Loc. Fountain Bluff, Illinois.

Athyris parvirostris Meek and Worthen=Cleiothyris roissyi.

Athyris parvula Whiteaves. Hamilton (Dev.).

Athyris parvula Whiteaves, Cont. Canadian Pal., I, 1891, p. 228, pl. 32, figs. 4, 5.

Loc. Athabasca River, Canada.

Athyris pectinifera? Swallow (non Sowerby)=Cleiothyris roissyi.

Athyris (?) perinflata McChesney. Keokuk (L. Carb.).

Athyris perinflata McChesney, Descriptions New Pal. Foss., 1861, p. 81.

Loc. Nauvoo, Illinois.

Athyris persinuata Meek=Seminula persinuata.

Athyris planosulcata American authors (non Phillips)=Cleiothyris roissyi.

Athyris plattensis Swallow=Seminula plattensis.

Athyris polita Hall. Chemung (Dev.).

Atrypa polita Hall, Geol. N. Y.; Rep. Fourth Dist., 1843, Tables of Organic Remains, 65, fig. 5.

Athyris ? polita Hall, Pal. New York, IV, 1867, p. 293, pl. 47, figs. 21–33.

Athyris polita Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 46, figs. 1–5

Loc. Jasper, Randolph, and Albion, New York.

Athyris prinstana Billings=Hindella prinstana.

Athyris prouti (Swallow). Chouteau (L. Carb.).

Spirigera prouti Swallow, Trans. St. Louis Acad. Sci., I, 1860, p. 649.

Athyris prouti Keyes, Geol. Survey Missouri, V, 1895, p. 91.

Loc. St. Louis County, etc., Missouri.

Athyris reflexa Swallow=Cleiothyris reflexa.

Athyris roissyi=Cleiothyris roissyi.

Athyris singletoni Swallow=Seminula singletoni.

Athyris (?) solitaria Billings. Anticosti (Sil.).

Athyris solitaria Billings, Catalogue Sil. Foss. Anticosti, 1866, p. 48.

Loc. Anticosti.

Athyris spiriferoides McChesney (non Eaton)=A. papilioniformis.

Athyris spiriferoides (Eaton). Corniferous and Hamilton (Dev.).

Terebratula spiriferoides Eaton, American Jour. Sci., XXI, 1831, p. 137;—Geological Text-book, 1832, p. 46.

Atrypa concentrica Conrad (non von Buch), Ann. Rep. Geol. Survey New York, 1838, p. 111.—Hall, Geol. New York; Rep. Fourth Dist, 1843, p. 198, fig. 5.

Spirifera spiriferoides Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 153, figs. 1, 2.—Rogers, Geol. Pennsylvania, II, Pt. II, 1858, p. 828, fig. 667.

Athyris spiriferoides Hall, Thirteenth Rep. N. Y. State Cab. Nat. Hist., 1860, p. 93, figs. 1–4;—Fifteenth Rep. Ibidem, 1862, p. 180, figs. 1–4;—Pal. New York, IV, 1867, p. 285, pl. 46, figs. 5–31.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, *p. 89, figs. 60, 61*; pl. 45, figs. 11–27.

Athyris spiriferoides (Eaton)—Continued.

Athyris concentrica Billings, Canadian Jour., VI, 1861, p. 145, figs. 54–57;—Geol. Canada, 1863, p. 373, fig. 399; p. 385, fig. 421.

Loc. New York; Pennsylvania; Maryland; Virginia; Cayuga and Widder, Canada.

Athyris squamosa Worthen=Cleiothyris squamosa.

Athyris sublamellosa Hall=Cleiothyris roissyi.

Athyris subquadrata Hall=Seminula subquadrata.

Athyris subtilita Hall=Seminula argentea.

Athyris trinucleus Hall=Seminula trinucleus.

Athyris trisinuatus McChesney=Meristina trisinuata.

Athyris tumida Roemer=Meristina tumida.

Athyris (?) tumidula Billings. Anticosti (Sil.).

Athyris tumidula Billings, Catalogue Sil. Foss. Anticosti, 1866, p. 47.

Loc. Anticosti.

Obs. Probably a species of Whitfieldella.

Athyris (?) turgida Shaler. Anticosti (Sil.).

Athyris turgida Shaler, Bull. Mus. Comp. Zool., 4, 1865, p. 69.—Miller, N. American Geol. Pal., 1889, p. 335.

Loc. Anticosti.

Athyris ultravarica McChesney. Keokuk (L. Carb.).

Athyris ultravarica McChesney, Descriptions New Pal. Fossils, 1861, p. 79.

Loc. Keokuk, Iowa.

Athyris umbonata Billings=Hindella umbonata.

Athyris unisulcata Billings=Pentagonia unisulcata.

Athyris vittata Hall=A. fultonensis.

ATRYPA Dalman. Genotype Anomia reticularis Linnæus.

Atrypa Dalman, Kongl. Svenska Vet.-Akad. Handl., för 1827, 1828, p. 102.—Billings, Canadian Nat. Geol., I, 1856, p. 134;—Canadian Jour., VI, 1861, p. 264.—Whitfield, Twentieth Rep. N. Y. State Cab. Nat. Hist., 1867, p. 141, pl. 1.—Hall, Pal. New York, IV, 1867, p. 312.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 88.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 163;—Thirteenth Ann. Rep. N. Y. State Geologist, 1895, p. 818.

Atrypa æquiradiata Conrad=Rensselæria æquiradiata.

Atrypa acutiplicata Conrad=Anoplotheca acutiplicata.

Atrypa acutirostrum Hall=Rhynchonella acutirostris.

Atrypa affinis Vanuxem=A. reticularis.

Atrypa altilis Hall=Camarotœchia plena.

Atrypa ambigua Hall=Camarella ambigua.

Atrypa aprinis Hall=Homœospira apriniformis.

Atrypa arata Conrad=Pentamerella arata.

Atrypa aspera American authors=A. spinosa.

Atrypa aspera occidentalis Hall=A. hystrix occidentalis.

Atrypa bidens Hall=Rhynchonella bidens.

Atrypa bidentata Hall=Rhynchonella bidentata.

Atrypa bisulcata Hall (non Vanuxem)=Cyclospira bisulcata.

Atrypa bisulcata Vanuxem (non Hall)=Whitfieldella bisulcata.

Atrypa brevirostris Hall=Anastrophia brevirostris.

Atrypa calvini Nettelroth = A. rugosa.
Atrypa camura Hall = Trematospira camura.
Atrypa capax Conrad = Rhynchotrema capax.
Atrypa chemungensis Conrad = A. reticularis.
Atrypa circulus Hall = Parastrophia hemiplicata.
Atrypa comis Owen = Gypidula comis.
Atrypa concentrica Conrad, and Hall = Athyris spiriferoides.
Atrypa concinna Hall = Nucleospira concinna.
Atrypa congesta Conrad = Hyattella congesta.
Atrypa congregata Conrad = Camarotœchia congregata.
Atrypa contracta Hall = Camarotœchia contracta.
Atrypa corallifera Hall = Dictyonella corallifera.
Atrypa crassirostrum Hall = Whitfieldella cylindrica.
Atrypa cuboides Vanuxem, and Hall = Hypothyris cuboides.
Atrypa cuneata Hall = Rhynchotretra cuneata americana.
Atrypa cuspidata Hall = Triplecia cuspidata.
Atrypa cylindrica Hall = Whitfieldella cylindrica.
Atrypa deflecta Hall = Zygospira deflecta.
Atrypa dentata Hall = Rhynchotrema dentata.

Atrypa desquamata Sowerby. Middle Devonian.
Atrypa desquamata Sowerby, Trans. Geol. Soc., 2d ser., V, 1840, pl. 56, figs. 19, 20.—Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 150, pl. 14, fig. 4.
Loc. Europe; Petoskey, Michigan; Eureka district, Nevada.

Atrypa disparilis Hall = Atrypina disparilis.
Atrypa dubia Hall = Protorhyncha dubia.
Atrypa dumosa Hall = A. spinosa.
Atrypa duplicata Hall = Camarotœchia duplicata.

Atrypa ellipsoidea Nettelroth. Corniferous (Dev.).
Atrypa ellipsoidea Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 90.
Loc. Falls of Ohio.

Atrypa elongata Conrad = Rensselæria ovoides.
Atrypa emacerata Hall = Rhynchonella emacerata.
Atrypa equiradiata Hall = Camarotœchia equiradiata.
Atrypa exigua Hall = Zygospira exigua.
Atrypa eximia Hall = Camarotœchia eximia.
Atrypa extans Emmons = Triplecia extans.
Atrypa flabella Shaler = Anoplotheca hemispherica.
Atrypa flabellites Conrad = Anoplotheca flabellites.
Atrypa galeatus Dalman = Gypidula galeata.

Atrypa(?) gibbosa Hall. Clinton (Sil.).
Atrypa gibbosa Hall, Pal. New York, II, 1852, p. 79, pl. 20, fig. 10.
Loc. Clinton, New York.

Atrypa globuliformis Vanuxem = Leiorhynchus globuliforme.
Atrypa hemiplicata Hall = Parastrophia hemiplicata.
Atrypa hemispherica Sowerby = Anoplotheca hemispherica.
Atrypa hirsuta Hall = Parazyga hirsuta.

Atrypa hystrix Hall. Chemung (Dev.).

Atrypa hystrix Hall, Geology N. Y.; Rep. Fourth Dist., 1843, p. 271, fig. 2.—Rogers, Geol. Pennsylvania, II, Pt. II, 1858, p. 829, fig. 681.—Hall, Pal. New York, IV, 1867, p. 326, pl. 53A, figs. 15–17.—Whitfield, Geol. Wisconsin, IV, 1882, p. 333, pl. 26, fig. 5.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 55, fig. 23.

Loc. Steuben County, New York; Pennsylvania; Rockford, Iowa; Milwaukee, Wisconsin.

Obs. See A. spinosa.

Atrypa hystrix elongata Webster. Chemung (Dev.).

Atrypa hystrix var. elongata Webster, American Nat., XXII, 1888, p. 1104.

Loc. Near Rockford, Iowa.

Atrypa hystrix occidentalis Hall. Middle Devonian.

Atrypa aspera var. occidentalis Hall, Geol. Survey Iowa, I, Pt. II, 1858, p. 515, pl. 6, fig. 3.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 55, figs. 18–20.

Atrypa aspera Meek and Worthen, Geol. Survey Illinois, III, 1868, p. 403, pl. 13, fig. 7.

Loc. Independence, Davenport, etc., Iowa; Rock Island, Illinois.

Obs. This variety is probably more closely related to A. hystrix than to A. aspera.

Atrypa hystrix planosulcata Webster. Chemung (Dev.).

Atrypa hystrix var. planosulcata Webster, American Nat., XXII, 1888, p. 1104.

Loc. Near Rockford, Iowa.

Atrypa imbricata Hall (non Sowerby)=A. nodostriata.

Atrypa impressa Hall=A. reticularis impressa.

Atrypa impressa Shaler (non Hall)=A. reticularis.

Atrypa increbescens Hall=Rhynchotrema inæquivalvis.

Atrypa intermedia Hall=Whitfieldella intermedia.

Atrypa interplicata Hall=Anastrophia interplicata.

Atrypa lævis Vanuxem=Meristella lævis.

Atrypa lacunosa Vanuxem=Anastrophia verneuili.

Atrypa lamellata Hall=Rhynchonella lamellata.

Atrypa(?) lara (Billings). Anticosti (Sil.).

Athyris lara Billings, Catalogue Sil. Foss. Anticosti, 1866, p. 47.

Atrypa lara Davidson, Suppl. British Sil. Brach., Palæontographical Soc., 1882, p. 121.

Loc. Anticosti.

Obs. Said to have a true Atrypa loop and spires. The exterior is smooth. Probably the type of a new genus.

Atrypa laticorrugata Foerste. Clinton (Sil.).

Atrypa lati-corrugata Foerste, Geol. Ohio, VII, 1895, p. 591, pl. 57A, fig. 16.

Loc. Dayton, Ohio.

Atrypa laticostata Hall (non Phillips)=Camarotœchia contracta.

Atrypa lentiformis Vanuxem=A. reticularis.

Atrypa limitaris Hall=Leiorhynchus limitare.

Atrypa (?) lingulata Nicollet. Lower Carboniferous.

Atrypa lingulata Nicollet, Rep. Hydrog. Basin Up. Miss. River, 1843, p. 167.

"Subfusiform; valves nearly equally convex; inferior valve with a longitudinal sinus; base projecting in the middle, the margin of the projection truncated. St. Louis, and also the bluff beneath Rockwell, Illinois."

Atrypa marginalis (Dalman). Niagara (Sil.).

Terebratula marginalis Dalman, Kongl. Svenska Vet.-Akad. Handl., för 1827, 1828, p. 59, pl. 6, fig. 6.

Atrypa marginalis Roemer, Sil. Fauna west. Tennessee, 1860, p. 69, pl. 5, fig. 10.—Billings, Catalogue Sil. Foss. Anticosti, 1866, p. 46.—Hall and Whitfield, Twenty-fourth Rep. New York State Cab. Nat. Hist., 1872, p. 197.—Foerste, Proc. Boston Soc. Nat. Hist., XXIV, 1890, p. 314, pl. 6, figs. 8, 9;—Geol. Ohio, VII, 1895, p. 591, pl. 25, figs. 6, 9; pl. 31, figs. 8, 9.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 55, figs. 24, 25.

Trematospira matthewsoni McChesney, Descriptions New Pal. Foss., 1860, p. 71;—Trans. Chicago Acad. Sci., I, 1868, p. 32, pl. 7, fig. 3.

Atrypa nodostriata Foerste (non Hall), Bull. Denison Univ., I, 1885, p. 90, pl. 13, fig. 9.

Atrypa marginalis var. multistriata Foerste, Proc. Boston Soc. Nat. Hist., XXIV, 1890, p. 316, pl. 6, fig. 8.

Loc. Europe; Anticosti; Dayton, Ohio; Hanover, Indiana; Louisville, Kentucky; Decatur County, Tennessee; Bridgeport, Illinois.

Atrypa masonii (Salter). Silurian.

Rhynchonella masonii Salter, Sutherland's Jour. Voyage Baffins Bay, etc., II, 1852, p. ccxxi, pl. 5, fig. 5.—Etheridge, Quart. Jour. Geol. Soc. London, XXXIV, 1878, p. 596.

Loc. Near Wellington Channel, Bessels Bay, lat. 81° 6′.

Atrypa medialis Vanuxem=Eatonia medialis.

Atrypa mesacostalis Hall=Leiorhynchus mesacostale.

Atrypa missouriensis Miller. Middle Devonian.

Atrypa missouriensis Miller, Eighteenth Ann. Rep. Geol. Survey Indiana, 1894, p. 315, pl. 9, figs. 19–21.

Loc. Near Otterville, Missouri.

Atrypa modesta Hall=Zygospira modesta.

Atrypa nasuta Conrad=Meristella nasuta.

Atrypa naviformis Hall=Whitfieldella naviformis.

Atrypa neglecta Hall=Camarotœchia neglecta.

Atrypa nitida Hall=Whitfieldella nitida.

Atrypa nitida oblata Hall=Whitfieldella oblata.

Atrypa nodostriata Foerste (non Hall)=A. marginalis.

Atrypa nodostriata Hall. Clinton and Niagara (Sil.).

Atrypa imbricata Hall (non Sowerby), Geol. N. Y.; Rep. Fourth Dist., 1843, Tab. Organic Remains, 13, fig. 1.

Atrypa nodostriata Hall, Pal. New York, II, 1852, p. 272, pl. 56, fig. 2.—Hall and Whitfield, Pal. Ohio, II, 1875, p. 133, pl. 7, figs. 12–14.

Loc. Lockport, New York; Yellow Springs, Ohio; Louisville, Kentucky; Wisconsin.

Atrypa nucleolata Hall=Whitfieldella nucleolata.

Atrypa nucleus Hall=Triplecia nucleus.

Atrypa nustella Castelnau=Eatonia peculiaris.

Atrypa oblata Hall=Whitfieldella oblata.

Atrypa obtusiplicata Hall=Camarotœchia obtusiplicata.

Atrypa octocostata Conrad=Pentamerella arata.

Atrypa palmata Morris and Sharpe=Anoplotheca flabellites.

Atrypa peculiaris Conrad=Eatonia peculiaris.

Atrypa phoca (Salter). Silurian.

Rhynchonella phoca Salter, Sutherland's Jour. Voyage Baffins Bay, etc., II, 1852, p. cexxvi, pl. 5, figs. 1–3.

Atrypa phoca Etheridge, Quart. Jour. Geol. Soc. London, XXXIV, 1878, p. 576.

Loc. Cape Riley, Cornwallis, Seal Islands, Bessels Bay, lat. 81° 6′, and Dobbins Bay, lat. 79° 41′, Arctic America.

Atrypa planoconvexa Hall=Anoplotheca planoconvexa.

Atrypa pleiopleura Conrad=Camarotœchia pleiopleura.

Atrypa plena Hall=Camarotœchia plena.

Atrypa plicata Hall=Rhynchonella plicata.

Atrypa plicatella Hall=Rhynchonella plicatella.

Atrypa plicatula Hall=Anoplotheca plicatula.

Atrypa plicifera Hall=Camarotœchia plena.

Atrypa polita Hall=Athyris polita.

Atrypa prisca Vanuxem=A. reticularis.

Atrypa pseudomarginalis Hall. Up. Helderberg (Dev.).

Atrypa pseudomarginalis Hall, Thirteenth Rep. N. Y. State Cab. Nat. Hist., 1860, p. 84;—Fifteenth Rep. Ibidem, 1862, p. 189;—Pal. New York, IV, 1867, p. 327, pl. 53, figs. 1, 2.—Hall and Clarke, Ibidem, VIII, Pt. II, 1895, pl. 55, figs. 26, 27.

Loc. Schoharie, New York.

Atrypa quadricostata Hall, 1843=Leiorhynchus quadricostatum.

Atrypa quadricostata Hall, 1852=Hyattella congesta.

Atrypa rectiplicata Conrad=Spirifer rectiplicatus.

Atrypa recurvirostris Hall=Zygospira recurvirostris.

Atrypa reticularis (Linnæus). Silurian and Devonian.

Anomia reticularis Linné, Systema Naturæ, ed. xii, I, 1767, p. 1132.

Atrypa chemungensis Conrad, Jour. Acad. Nat. Sci. Philadelphia, VIII, 1842, p. 265.—Vanuxem, Geol. New York; Rep. Third Dist., 1842, p. 182, fig. 4.

Hipparionyx consimilaris Vanuxem, Geol. New York; Rep. Third Dist., 1842, p. 132, fig. 2.

Atrypa affinis Vanuxem, Geol. New York; Rep. Third Dist., 1842, p. 88, fig. 12.—Hall, Ibidem, Rep. Fourth Dist., 1843, p. 88, fig. 12.

Atrypa prisca Vanuxem, Geol. New York; Rep. Third Dist., 1842, p. 139, fig. 5.—Hall, Ibidem, Rep. Fourth Dist., 1843, p. 175, fig. 5; p. 198, fig. 4.—Owen, Geol. Expl. Iowa, Wisconsin, Illinois, 1844, pl. 12, figs. 2, 10.—Billings, Canadian Nat. Geol., I, 1856, p. 474, pl. 7, fig. 11.

Atrypa lentiformis Vanuxem, Geol. New York; Rep Third Dist., 1842, p. 163, fig. 3; p. 164.—Hall, Ibidem, Rep. Fourth Dist., 1843, p. 215, fig. 3.

Strophomena ithacensis Vanuxem, Geol. New York; Rep. Third Dist., 1842, p. 174, fig. 2. (On the authority of Professor Williams.)

Atrypa tribulis Hall, Geol. New York; Rep. Fourth Dist., 1843, p. 271, fig. 3.

Terebratula prisca Castelnau, Essai Syst., Sil. l'Amérique Septentrionale, 1843, p. 40, pl. 13, fig. 8.

Terebratula reticularis Hall, American Jour. Sci., 2d ser., XX, 1849, p. 227.—Yandell and Shumard, Cont. Geol. Kentucky, 1847, p. 10.

Atrypa reticularis Hall, Pal. New York, II, 1852, p. 72, pl. 23, fig. 8; p. 270, pl. 55, fig. 5.—Billings, Canadian Nat. Geol., I, 1856, p. 137, pl. 2, fig. 10.—Hall, Geol. Survey Iowa, II, 1858, p. 515;—Pal. New York, III, 1859, p. 253, pl. 42, fig. 1.—Roemer, Sil. Fauna west. Tennessee, 1860, p. 69, pl. 5, fig. 9.—Billings, Canadian Jour., VI, 1861, p. 264, figs. 84–87;—Geol. Canada, 1863, p. 318,

Atrypa reticularis (Linnæus)—Continued.

fig. 335; p. 384, fig. 416.—Hall, Pal. New York, IV, 1867, p. 316, pl. 52, figs. 1–3, 7–12; pl. 53, figs. 3–19; pl. 53A, figs. 22, 23.—Meek, Trans. Chicago Acad. Sci., I, 1868, p. 97, pl. 13, fig. 13.—Meek and Worthen, Geol. Survey Illinois, III, 1868, p. 432, pl. 13, fig. 11.—Meek, Simpson's Rep. Expl. Great Basin Terr. Utah, 1876, p. 347, pl. 1, fig. 6;—King's U. S. Geol. Survey Expl. 40th Parl., IV, 1877, p. 38, pl. 1, fig. 7; pl. 3, fig. 6.—Etheridge, Quart. Jour. Geol. Soc. London, XXXIV, 1878, p. 596.—Hall, Twenty-eighth Rep. New York State Mus. Nat. Hist., 1879, p. 162, pl. 25, figs. 44–47.—White, Sec. Ann. Rep. Indiana Bureau Statistics and Geol., 1880, p. 502, pl. 5, figs. 7–9;—Tenth Rep. State Geol. Indiana, 1881, p. 134, pl. 5, figs. 7–9;—Ibidem, Eleventh Rep., 1882, p. 304, pl. 25, figs. 44–47.—Whitfield, Geol. Wisconsin, IV, 1882, p. 333, pl. 26, fig. 6.—Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 150, pl. 14, fig. 6.—Beecher and Clarke, Mem. New York State Mus. Nat. Hist., I, 1889, p. 51, pl. 4, figs. 12–20.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Survey, 1889, p. 91, pl. 14, figs. 12–23; pl. 15, fig. 1.—Foerste, Proc. Boston Soc. Nat. Hist., XXIV, 1890, p. 314.—Whiteaves, Cont. Canadian Pal., I, 1892, p. 289, pl. 37, fig. 8.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 165, fig. 153; pl. 55, figs. 1–17.—Herrick, Geol. Ohio, VII, 1895, pl. 20, fig. 7.

Atrypa impressa Shaler (non Hall), Bull. Mus. Comp. Zool., 4, 1865, p. 68.

Loc. A characteristic fossil of the Silurian and Devonian throughout the world.

Atrypa reticularis impressa Hall. Schoharie grit (Dev.).

Atrypa impressa Hall, Tenth Rep. New York State Cab. Nat. Hist., 1857, p. 122, figs. 1–7;—Pal. New York, IV, 1867, p. 315, pl. 51, figs. 1–9.

Loc. Schoharie, Clarksville, etc., New York.

Atrypa reticularis niagarensis Nettelroth. Niagara (Sil.).

Atrypa reticularis var. niagarensis Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 92, pl. 32, figs. 5–8, 44–47.

Loc. Jefferson County, Kentucky; Clarke County, Indiana.

Atrypa reticularis nuntia Hall and Whitfield. Hamilton (Dev.).

Atrypa reticularis Hall, Pal. New York, IV, 1867, p. 316, pl. 51, figs. 10–24.

Atrypa reticularis var. nuntia Hall and Whitfield, Twenty-fourth Rep. New York State Cab. Nat. Hist., 1872, p. 199.

Loc. Falls of Ohio.

Atrypa reticularis ventricosa Hall and Whitfield. Hamilton (Dev.).

Atrypa reticularis Hall, Pal. New York, IV, 1867, p. 316, pl. 52, figs. 4–6.

Atrypa reticularis var. ventricosa Hall and Whitfield, Twenty-fourth Rep. New York State Cab. Nat. Hist., 1872, p. 199.

Loc. Falls of Ohio.

Atrypa robusta Hall=Rhynchonella robusta.

Atrypa rostrata Hall=Meristella rostrata.

Atrypa rugosa Hall. Niagara (Sil.).

Atrypa rugosa Hall, Pal. New York, II, 1852, p. 271, pl. 56, fig. 1.—Hall and Clarke, Ibidem, VIII, Pt. II, 1893, p. 171.

Rhynchonella rugosa Billings, Geol. Canada, 1863, p. 315, fig. 321.

Atrypa calvini Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 89, pl. 32, figs. 64–66.

Loc. Lockport, New York; Anticosti; Osgood, Indiana; Louisville, Kentucky.

Atrypa scitula Hall=Charionella scitula.

Atrypa semiplicata Conrad=Rhynchonella semiplicata.

Atrypa singularis Vanuxem=Eatonia singularis.

Atrypa sordida Hall=Rhynchonella sordida.

Atrypa spinosa Hall. Corniferous-Chemung (Dev.).

Atrypa spinosa Hall, Geol. New York; Rep. Fourth Dist., 1843, p. 200, figs. 1, 2.—Whitfield, Geol. Wisconsin, IV, 1882, p. 333, pl. 26, figs. 7, 8.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 55, figs. 21, 22.

Atrypa dumosa Hall, Geol. New York; Rep. Fourth Dist., 1843, p. 271, fig. 1.

Atrypa aspera Hall (non Schlotheim), Tenth Rep. New York State Cab. Nat. Hist., 1857, p. 168.—Rogers, Geol. Pennsylvania, II, 1858, Pt. II, p. 828, fig. 671.—Meek, Trans. Chicago Acad. Sci., I, 1868, p. 96, pl. 13, fig. 12.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 88, pl. 14, figs. 1–11.

Atrypa aspera vel aspera Hall, Pal. New York, IV, 1867, p. 322, pl. 53A, figs. 1–14, 18, 24, 25.

Atrypa aspera? Meek, Simpson's Rep. Expl. Great Basin Terr. Utah, 1876, p. 348, pl. 1, fig. 2.

Atrypa reticularis var. aspera Whiteaves, Cont. Canadian Pal., I, 1891, pp. 229, 289.

Loc. New York; Pennsylvania; Maryland; Virginia; Kentucky; Ohio; Illinois; Iowa; Wisconsin; Ontario; Lockhart and Athabasca rivers, etc., Northwest Territory, Canada.

Obs. The Corniferous limestone specimens of A. spinosa are not always easily distinguished from A. reticularis. The fewer plications of the former, however, will usually distinguish it from the latter species. This tendency to fewer plications is more marked in the Hamilton formation and attains its climax in the Chemung, where the species is known as A. hystrix.

Atrypa subtrigonalis Hall=Rhynchonella subtrigonalis.

Atrypa sulcata Vanuxem=Whitfieldella sulcata.

Atrypa tenuilineata Hall=Dalmanella tenuilineata.

Atrypa tribulis Hall=A. reticularis.

Atrypa unguiformis Hall=Hipparionyx proximus.

Atrypa unisulcata Conrad=Pentagonia unisulcata.

ATRYPINA Hall and Clarke. Genotype Leptocœlia imbricata Hall.

Atrypina Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 161, fig. 152;—Thirteenth Ann. Rep. New York State Geologist, 1895, p. 815.

Atrypina clintoni Hall and Clarke. Clinton (Sil.).

Atrypina clintoni Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 162, pl. 53, figs. 7, 17–19; pl. 83, fig. 6.

Loc. Orleans County, New York.

Atrypina disparilis (Hall). Niagara (Sil.).

Atrypa disparilis Hall, Pal. New York, II, 1852, p. 277, pl. 57, fig. 6.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 53, figs. 1–4.

Leptocœlia disparilis Hall, Twelfth Rep. New York State Cab. Nat. Hist., 1859, p. 77.

Trematospira? disparilis Hall, Sixteenth Rep., Ibidem, 1863, p. 60;—Trans. Albany Institute, IV, 1863, p. 146.

Cœlospira disparilis Hall, Twenty-eighth Rep. New York State Mus. Nat. Hist., 1879, p. 162, pl. 25, figs. 39–43;—Eleventh Rep. State Geol. Indiana, 1882, p. 363, pl. 25, figs. 39–43.—Beecher and Clarke, Mem. New York State Mus. Nat. Hist., I, 1889, p. 64, pl. 5, figs. 17–23.

Loc. Wolcott, New York; Waldron, Indiana.

Obs. Davidson in 1882 regarded this species the same as Atrypa barrandei of Europe.

Atrypina imbricata Hall. Lower Helderberg (Dev.).

Leptocœlia imbricata Hall, Tenth Rep. New York State Cab. Nat. Hist., 1857, p. 108;—Pal. New York, III, 1859, p. 246, pl. 38, figs. 8–13.—Billings, Geol. Canada, 1863, p. 957, fig. 452.

Trematospira imbricata Hall, Sixteenth Rep. New York State Cab. Nat. Hist., 1863, p. 60;—Trans. Albany Institute, IV, 1863, p. 146.—Keyes, Geol. Survey Missouri, V, 1895, p. 96.

Trematospira ? imbricata Meek and Worthen, Geol. Survey Illinois, III, 1868, p. 381, pl. 7, fig. 2.

Atrypina imbricata Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 53, figs. 5, 6, 8–10.

Loc. Albany and Schoharie counties, New York; Perry County, Missouri.

Atrypina intermedia (Hall). Arisaig (Sil.).

Leptocœlia intermedia Hall, Canadian Nat. Geol., V, 1860, p. 147, fig. 5.—Dawson, Acadian Geology, 3d ed., 1878, p. 598, fig. 202.

Loc. Arisaig, Nova Scotia.

Avicula desquamata Hall=Obolella crassa.

AULACORHYNCHUS Dittmar. Genotype A. pachti Dittmar.

Aulacorhynchus Dittmar, Verhand. Kais. Mineral. Gessel. St. Petersburg, 2d ser., VII, 1871, p. 1, pl. 1, figs. 1–13.—Hall and Clarke, Pal, New York, VIII, Pt. II, 1893, p. 311;—Thirteenth Ann. Rep. New York State Geologist, 1895, p. 904.

Isogramma Meek and Worthen, Geol. Survey Illinois, V, 1873, p. 568.

Aulacorhynchus millipunctatum (Meek and Worthen). Up. Coal Meas.

Chonetes ? ? millipunctata Meek and Worthen, Proc. Acad. Nat. Sci. Philadelphia, 1870, p. 35;—Geol. Survey Illinois, V, 1873, p. 566, pl. 25, fig. 3.

Isogramma millipunctata Meek and Worthen, Ibidem, 1873, p. 568.

Aulacorhynchus millipunctatus Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 312, pl. 83, figs. 14, 15.

Chonetes millipunctatus Keyes, Geol. Survey Missouri, V, p. 54.

Loc. Marion County, Illinois; Kansas City, Missouri.

Aulosteges guadalupensis Shumard=Strophalosia guadalupensis.

Aulosteges spondyliformis White and St. John=Strophalosia spondyliformis.

Barrandella Hall and Clarke=Clorinda.

BARROISELLA Hall and Clarke. Genotype Lingula subspatulata Meek and Worthen (non Hall and Meek).

Barroisella Hall and Clarke, Pal. New York, Extract, VIII, Pt. I, 1890, p. 62;—Pal. New York, VIII, Pt. I, 1892, pp. 62, 64;—Eleventh Ann. Rep. New York State Geologist, 1894, p. 230.

Barroisella subspatulata (Meek and Worthen). Black Slate (Dev.).

Lingula subspatulata Meek and Worthen (non Hall and Meek), Geol. Survey Illinois, III, 1868, p. 437, pl. 13, fig. 1.

Lingula subspatulata ? A. Winchell, Proc. American Phil. Soc., XII, 1870, p. 248.

Barroisella subspatulata Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 63, pl. 2, figs. 14–16 and p. 164.

Loc. Jonesboro, Illinois; Louisville and Lebanon, Kentucky; Rockford, Indiana.

BEACHIA Hall and Clarke. Genotype Meganteris suessana Hall.

Beachia Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 260;—Thirteenth Ann. Rep. New York State Geologist, 1895, p. 850.

Beachia suessana Hall. Oriskany (Dev.).

Meganteris suessana Hall, Tenth Rep. New York State Cab. Nat. Hist., 1857, p. 100.

Rensselæria suessana Hall, Pal. New York, III, 1859, p. 459, pl. 107, figs. 1-15.

Beachia suessana Hall and Clarke, Ibidem, VIII, Pt. II, 1893, p. 260, pl. 77, figs. 1-11.

Loc. Cumberland, Maryland; near Rondout, New York.

BEECHERIA Hall and Clarke. Genotype B. davidsoni Hall and Clarke.

Beecheria Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 300;—Thirteenth Ann. Rep. New York State Geologist, 1895, p. 866.

Beecheria davidsoni Hall and Clarke. Upper Carboniferous.

Beecheria davidsoni Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 300, fig. 224, pl. 79, figs. 33-36.

Loc. Windsor, Nova Scotia.

BILLINGSELLA Hall and Clarke.

Genotype Orthis pepina Hall=O. coloradoensis Shumard.

Billingsella and Protorthis Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 230, 231;—Eleventh Ann. Rep. New York State Geologist, 1894, p. 273.

Obs. Protorthis was founded on Orthis billingsi Hartt, a species rarely found in good preservation. The diagnostic character was supposed to be the presence of a rudimentary spondylium and the absence of a deltidium. In the National Museum collection, however, there are two artificial casts of the ventral valve made from Hartt's original specimens and other material collected by Mr. Walcott, showing O. billingsi to be without a spondylium. The rostral plate is the deltidium distorted by pressure to which these shells have been subjected. The only character of generic importance is that the geologically older species of Billingsella have a more rudimentary or nearly obsolete cardinal process than the type species. This difference, however, hardly justifies the retention of Protorthis.

Billingsella alberta (Walcott). Middle Cambrian.

Orthisina alberta Walcott, Proc. U. S. National Mus., XI, 1888, p. 442.

Loc. Mount Stephan, British Columbia.

Billingsella billingsi (Hartt). Middle Cambrian.

Orthis billingsi Hartt, Dawson's Acadian Geology, 2d ed., 1868, p. 644, fig. 223.—Walcott, Bull. U. S. Geol. Survey, 10, 1884, p. 17, pl. 1, fig. 1.—Matthew, Trans. Royal Soc. Canada, III, 1886, p. 43.

Orthis? billingsi Matthew, Ibidem, VIII, 1891, p. 131.

Protorthis billingsi Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 219, 232, pl. 7A, figs. 14-20.

Loc. St. John, New Brunswick.

Billingsella coloradoensis (Shumard). Upper Cambrian.

Orthis coloradoensis Shumard, Trans. St. Louis Acad. Sci., I, 1860, p. 627.

Orthis pepina Hall, Sixteenth Rep. New York State Cab. Nat. Hist., 1863, p. 134, pl. 6, figs. 23-27;—Trans. Albany Institute, V, 1867, p. 113.—Whitfield, Geol. Wisconsin, IV, 1882, p. 170, pl. 1, figs. 4, 5.

Orthis? (Orthisina?) pepina Hall, Second Ann. Rep. New York State Geologist, 1883, pl. 37, figs. 16-19.

Billingsella pepina Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 230, pl. 7, figs. 16-19; pl. 7A, figs. 7-9.

Orthis (Billingsella) pepina Sardeson, Bull. Minnesota Acad. Nat. Sci., IV, 1896, p. 96.

Loc. Burnett County, Texas; Lake Pepin, Minnesota; St. Croix River and Berlin, Wisconsin.

Billingsella festinata (Billings). Lower Cambrian.

Orthisina festinata Billings, Pal. Fossils, I, 1861, p. 10, figs. 11, 12;—Geol. Vermont, II, 1861, p. 949, figs. 350–352;—American Jour. Sci., 2d ser., XXXIII, 1862, p. 105;—Geology Canada, 1863, p. 284, fig. 289.—Walcott, Bull. U. S. Geol. Survey, 30, 1886, p. 120, pl. 7, fig. 7;—Tenth Ann. Rep. U. S. Geol. Survey, 1891, p. 613, pl. 72, fig. 7.

Billingsella festinata Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 230.

Loc. Swanton, Vermont; York, Pennsylvania.

Billingsella (?) grandæva (Billings). Calciferous (Ord.).

Orthisina grandæva Billings, Canadian Nat. Geol., IV, 1859, p. 349, fig. 1;—Geology Canada, 1863, p. 113, fig. 21.

Billingsella? grandæva Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 231.

Loc. Mingan Island, Gulf of St. Lawrence.

Billingsella latourensis (Matthew). Middle Cambrian.

Kutorgina latourensis Matthew, Trans. Royal Soc. Canada, III, 1886, p. 42, pl. 5, fig. 18.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 93, 95, 233, pl. 4, figs. 18–20.

Loc. Portland, New Brunswick.

Billingsella (?) laurentina (Billings). Anticosti (Sil.).

Orthis laurentina Billings, Geol. Survey Canada; Rep. for 1856, 1857, p. 297;—Pal. Fossils, I, 1862, p. 138, fig. 115.

Billingsella? laurentina Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 194, 231, 238, pl. 7A, figs. 1–6.

Loc. Anticosti.

Billingsella orientalis (Whitfield). Lower Cambrian.

Orthisina orientalis Whitfield, Bull. American Mus. Nat. Hist., I, 1884, p. 144, pl. 14, fig. 6.—Walcott, Bull. U. S. Geol. Survey, 30, 1886, p. 120, pl. 7, fig. 6;—Tenth Ann. Rep. U. S. Geol. Survey, 1891, p. 613, pl. 72, fig. 8.

Billingsella orientalis Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 230.

Loc. Georgia and Swanton, Vermont.

Billingsella (?) primordialis (Whitfield). Calciferous (Ord.).

Streptorhynchus? primordiale Whitfield, Bull. American Mus. Nat. Hist., I, 1886, p. 301, pl. 24, fig. 7.

Billingsella? primordiale Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 231.

Loc. Fort Cassin, Vermont.

Billingsella quacoensis (Matthew). Middle Cambrian.

Orthis quacoensis Matthew, Trans. Royal Soc. Canada, III, 1886, p. 43, pl. 5, fig. 20.

Orthis? quacoensis Matthew, Ibidem, VIII, 1891, p. 131.

Protorthis quacoensis Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 232, pl. 7A, fig. 21.

Loc. Portland and St. Martins, New Brunswick.

Billingsella transversa (Walcott). Lower Cambrian.

Orthisina? transversa Walcott, Bull. U. S. Geol. Survey, 30, 1886, p. 121, pl. 7, fig. 5;—Tenth Ann. Rep. U. S. Geol. Survey, 1891, p. 613, pl. 72, fig. 9.

Billingsella transversa Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 230.

Loc. Georgia, Vermont.

Billingsella whitfieldi (Walcott). Lower Cambrian.

Kutorgina whitfieldi Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 18, pl. 9, fig. 4.

Loc. Eureka district, Nevada.

Billingsia Ford (non de Koninck, 1876)=Elkania.

BILOBITES Linnæus. Genotype Anomia biloba Linnæus.

Bilobites Linnæus, Systema Naturæ, ed. Muller, VI, 1775, p. 325.—Hall, Bull. Geol. Soc. America, I, 1889, p. 21.—Beecher, American Jour. Sci., 3d ser., XLII, 1891, p. 51.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 204, 223;—Eleventh Ann. Rep. New York State Geologist, 1894, p. 269.

Dicœlosia King, Mon. Permian Fossils England, Pal. Soc., 1850, p. 106.

Bilobites acutilobus (Ringueberg). Niagara (Sil.).

Orthis acutiloba Ringueberg, Proc. Acad. Nat. Sci. Philadelphia, 1888, p. 134, pl. 7, fig. 5.

Bilobites acutilobus Beecher, American Jour. Sci., 3d ser., XLII, 1891, p. 52, pl. 1, fig. 1.

Loc. Lockport, New York.

Bilobites bilobus (Linnæus). Niagara (Sil.).

Anomia biloba Linnæus, Systema Naturæ, ed. XII, 1767, p. 1154.

Delthyris sinuatus Hall, Geol. New York; Rep. Fourth Dist., 1843, p. 105, fig. 8.

Spirifer bilobus Hall, American Jour. Sci., 2d ser., XX, 1849, p. 228;—Pal. New York, IV, 1852, p. 260, pl. 54, fig. 1.

Orthis biloba Hall, Twelfth Rep. New York State Cab. Nat. Hist., 1859, p. 85;—Eleventh Rep. State Geol. Indiana, 1882, p. 286, pl. 27, fig. 16.

Bilobites bilobus Beecher, American Jour. Sci., 3d ser., XLII, 1891, p. 52, pl. 1, fig. 28.

Bilobites biloba Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 190, 204, 205, 223, pl. 5B, figs. 11–14.

Loc. Lockport, New York; Waldron, Indiana; Wisconsin.

Bilobites varicus (Conrad). Lower Helderberg (Dev.).

Delthyris bilobata Conrad (not Orthis bilobata Sowerby), Second Ann. Rep. New York Geol. Survey, 1838, pp. 112, 118.

Delthyris varica Conrad, Jour Acad. Nat. Sci. Philadelphia, VIII, 1842, p. 262, pl. 14, fig. 20.

Orthis varica Hall, Pal. New York, III, 1859, p. 179, pl. 24, fig. 1.

Orthis (Dicœlosia) varica Hall, Second Ann. Rep. New York State Geol., 1883, pl. 35, figs. 38–42.

Bilobites varicus Beecher, American Jour. Sci., 3d ser., XLII, 1891, p. 52, pl. 1, figs. 3–27.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 204, 223, pl. 5B, figs. 15–19.

Loc. Albany and Schoharie counties, New York; Decatur County, Tennessee; St. Blandine, New Brunswick.

BOTSFORDIA Matthew. Genotype Obolus pulcher Matthew.

Obolus (Botsfordia) Matthew, Trans. Royal Soc. Canada, VIII, 1891, p. 148; X, p. 90.

Botsfordia pulchra Matthew. Middle Cambrian.

Obolus pulcher Matthew, Canadian Record of Science, III, 1889, p. 306;—Trans. Royal Soc. Canada, VII, 1890, p. 151, pl. 8, figs. 1, 2.

Obolus (Botsfordia) pulcher Matthew, Trans. Royal Soc. of Canada, VIII, 1891, p. 148.

Obolus? pulcher Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 81, 183, pl. 4K, fig. 22.

Obolus (Botsfordia) pulchra Matthew, Trans. Royal Soc. Canada, X, 1894, p. 90, pl. 16, fig. 3.

Botsfordia pulchra Matthew, Trans. New York Acad. Sci., XIV, 1895, p. 115, pl. 3.

Loc. Canton Island, New Brunswick.

Brachymerus Shaler (non Dejean, 1834)=Anastrophia.

Brachymerus reversus Shaler=Parastrophia reversa.

Brachyprion Shaler=Stropheodonta.
Brachyprion geniculatum Shaler=Stropheodonta geniculata.
Brachyprion leda Shaler=Rafinesquina leda.
Brachyprion ventricosum Shaler=Stropheodonta ventricosa.

CAMARELLA Billings. Genotype C. volborthi Billings.
Camarella Billings, Canadian Nat. Geol., IV, 1859, p. 301;—Ibidem, VI, 1861, p. 316.—Walcott, Bull. U. S. Geol. Survey, 30, 1886, p. 122.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 48.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 219;—Thirteenth Ann. Rep. New York State Geologist, 1895, p. 838.

Camarella ambigua (Hall). Trenton (Ord.).
Atrypa ambigua Hall, Pal. New York, I, 1847, p. 143, pl. 33, figs. 8, 9.
Triplesia? ambigua Hall, Twelfth Rep. New York State Cab. Nat. Hist., 1859, p. 65.
Camarella ambigua Miller, American Pal. Foss., 1879, p. 107.
Loc. Middleville, New York.

Camarella antiquata Billings=Protorhyncha antiquata.
Camarella bisulcata Emmons=Cyclospira bisulcata.
Camarella bernensis Sardeson=Parastrophia hemiplicata.

Camarella breviplicata Billings. Calciferous (Ord.).
Camarella breviplicata Billings, Pal. Fossils, I, 1865, p. 304, fig. 295.
Loc. Stanbridge, Quebec, Canada.

Camarella calcifera Billings=Syntrophia calcifera.
Camarella circularis Miller=Parastrophia hemiplicata.

Camarella(?) costata Billings. Calciferous (Ord.).
Camarella? costata Billings, Pal. Fossils, I, 1865, p. 305, fig. 296.
Loc. Stanbridge, Quebec, Canada.

Camarella hemiplicata Billings=Parastrophia hemiplicata.

Camarella lenticularis Billings. Anticosti (Sil.).
Camarella lenticularis Billings, Catalogue Sil. Foss. Anticosti, 1866, p. 45.
Loc. Anticosti.

Camarella longirostris Billings. Chazy (Ord.).
Camarella longirostra Billings, Canadian Nat. Geol., IV, 1859, p. 302; p. 445, fig. 23;—Geol. Canada, 1863, p. 127, fig. 53.
Loc. Mingen Islands, Gulf of St. Lawrence.

Camarella minor Walcott=Protorhyncha minor.
Camarella ops Billings=Parastrophia ops.
Camarella owatonnensis Sardeson=Cyclospira bisulcata.

Camarella panderi Billings. Black River (Ord.).
Camarella panderi Billings, Canadian Nat. Geol., IV, 1859, p. 302;—Geol. Canada, 1863, p. 143, fig. 78.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 220, pl. 62, figs. 19–23.
Loc. Pauquettes Rapids, Canada; Curdsville, Kentucky.

Camarella parva Billings. Calciferous (Ord.).
Camarella parva Billings, Pal. Fossils, I, 1865, p. 219.
Camarella parva? Matthew, Trans. Royal Soc. Canada, XI, 1893, p. 103, pl. 7, fig. 9.
Loc. Table Head and Portland Creek, Newfoundland; near St. John, New Brunswick.

Camarella polita Billings. Calciferous (Ord.).

Camarella polita Billings, Pal. Fossils, I, 1865, p. 305, fig. 297 on p. 304.

Loc. Stanbridge, Quebec, Canada.

Camarella reversa Billings=**Anastrophia reversa.**

Camarella varians Billings. Calciferous-Chazy (Ord.).

Camarella varians Billings, Canadian Nat. Geol., IV, 1859, p. 445, fig. 24;—Geol. Canada, 1863, p. 127, fig. 52;—Pal. Fossils, I, 1865, p. 220.

Loc. Mingan Islands, Gulf of St. Lawrence; Table Head and Portland Creek, Newfoundland; Chazy, New York.

Camarella volborthi Billings. Black River (Ord.).

Camarella volborthi Billings, Canadian Nat. Geol., IV, 1859, p. 301;—Geol. Canada, 1863, p. 143, fig. 77.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 220, pl. 62, figs. 11–18; pl. 84, fig. 42.

Loc. Pauquettes Rapids, Ontario, Canada.

Camarium Hall=**Merista.**

Camarium elongatum Hall=**Merista typus.**

Camarium meeki Hall=**Meristella meeki.**

Camarium princeps Hall=**Meristella princeps.**

Camarium typus Hall=**Merista typus.**

CAMAROPHORELLA Hall and Clarke.

Genotype Pentamerus lenticularis White and Whitfield.

Camarophorella Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 215;—Thirteenth Ann. Rep. New York State Geologist, 1895, p. 838.

Camarophorella lenticularis (White and Whitfield).

Burlington (L. Carb.).

Pentamerus lenticularis White and Whitfield, Jour. Boston Soc. Nat. Hist., VIII, 1862, p. 295.

Camarophorella lenticularis Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 215, pl. 62, figs. 46–48.

Loc. Burlington, Iowa.

CAMAROPHORIA King. Genotype Terebratula schlotheimi von Buch.

Camarophoria King, Ann. Mag. Nat. Hist., XVIII, 1846, p. 89;—Mon. Permian Foss. England, Pal. Soc., 1850, p. 113.—Hall, Pal. New York, IV, 1867, p. 435.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 212;—Thirteenth Ann. Rep. New York State Geologist, 1895, p. 837.

Stenochisma Œhlert (non Conrad), Fischer's Manuel Conchyliologie, 1887, p. 1309.

Camarophoria(?) bisulcata Shumard. Upper Carboniferous.

Camarophoria(?) bisulcata Shumard, Trans. St. Louis Acad. Sci., I, 1858, p. 296, pl. 11, fig. 2.

Loc. Guadalupe Mountains of New Mexico and Texas.

Camarophoria caput-testudinis (White). Burlington (L. Carb.).

Rhynchonella caput-testudinis White, Proc. Boston Soc. Nat. Hist., IX, 1862, p. 23.

Camarophoria caput-testudinis Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 215.

Loc. Burlington, Iowa.

Obs. Probably identical with C. ringens Swallow.

Camarophoria eucharis Hall=**Camarospira eucharis.**

Camarophoria explanata (McChesney). Kaskaskia (L. Carb.).

Rhynchonella explanata McChesney, Descriptions New Pal. Foss., 1860, p. 50;—Trans. Chicago Acad. Sci., I, 1868, p. 30, pl. 6, fig. 7.

Camarophoria explanata (McChesney)—Continued.

Pugnax explanatus Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 60, figs. 43–45.

Loc. Chester, Illinois; Princeton, Kentucky.

Obs. Specimens of this species in Mr. Ulrich's collection prove it to be a Camarophoria.

Camarophoria giffordi Worthen=Enteletes hemiplicatus.

Camarophoria globulina Geinitz (non Phillips)=Pugnax utah.

Camarophoria globulina Davidson=Pugnax globulina.

Camarophoria occidentalis Miller. Burlington (L. Carb.).

Camarophoria occidentalis Miller, Jour. Cincinnati Soc. Nat. Hist., IV, 1881, p. 8, pl. 7, fig. 7.

Loc. Lake Valley district, New Mexico.

Camarophoria osagensis Swallow=Pugnax utah.

Camarophoria ringens (Swallow). Keokuk (L. Carb.).

Rynchonella ringens Swallow, Trans. St. Louis Acad. Sci., I, 1860, p. 653.—Keyes, Geol. Survey Missouri, V, 1895, p. 102.

Camarophoria ringens Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 214.

Loc. Callaway County, Missouri.

Obs. Compare with C. caput-testudinis and Rhynchonella striata. The writer has seen specimens of R. ringens from Callaway County, Missouri, Swallow's original locality.

Camarophoria rhomboidalis Hall and Clarke. Corniferous (Dev.).

Camarophoria rhomboidalis Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, p. 366, pl. 62, figs. 25-29.

Loc. Cass County, Indiana.

Camarophoria subcuneata Hall. St. Louis (L. Carb.).

Rhynchonella subcuneata Hall, Trans. Albany Institute, IV, 1858, p. 11;—Geol. Survey Iowa, I, Pt. II, 1858, p. 658, pl. 23, fig. 3.—Whitfield, Bull. American Mus. Nat. Hist., I, 1882, p. 51, pl. 6, figs. 47–49.—Hall, Twelfth Rep. State Geol. Indiana, 1883, p. 333, pl. 29, figs. 47–49.—Herrick, Bull. Denison Univ., III, 1888, p. 39, pl. 7, fig. 23.—Keyes, Geol. Survey Missouri, V, 1895, p. 102.

Camarophoria subcuneata Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pl. 62, figs. 34–37.

Loc. Spergen Hill and Bloomington, Indiana. In the Waverly at Granville, Ohio, according to Herrick.

Obs. See Rhynchonella arctirostrata.

Camarophoria subtrigona Meek and Worthen. Keokuk (L. Carb.).

Rhynchonella subtrigona Meek and Worthen, Proc. Acad. Nat. Sci., Philadelphia, 1860, p. 451.—Keyes, Geol. Survey Missouri, V, 1895, p. 102.

Rhynchonella parvini McChesney, Descriptions New Pal. Foss., 1861, p. 83;—Ibidem, 1865, pl. 6, fig. 2.

Camarophoria subtrigona Meek and Worthen, Geol. Survey Illinois, II, 1866, p. 251, pl. 18, fig. 7.—McChesney, Trans. Chicago Acad. Sci., I, 1868, p. 31, pl. 6, fig. 2.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 214, pl. 62, figs. 38–43.

Camarophoria ringens Hall and Clarke (non Swallow), Ibidem, 1893, pl. 84, fig. 5.

Loc. Keokuk, Iowa; Nauvoo and Warsaw, Illinois.

Camarophoria swallovana Shumard=Pugnax swallovana.

Camarophoria thera (Walcott). Lower Carboniferous.

Rhynchonella thera Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 223, pl. 7, fig. 6.

Loc. Eureka district, Nevada.

Camarophoria(?) wortheni (Hall). Warsaw (L. Carb.).

Rhynchonella wortheni Hall, Trans. Albany Institute, IV, 1858, p. 11.

Camarophoria? wortheni Whitfield, Bull. American Mus. Nat. Hist., I, 1882, p. 54, pl. 6, figs. 35–39.—Hall, Twelfth Rep. State Geol. Indiana, 1883, p. 334, pl. 29, figs. 35–39.

Camarophoria wortheni Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 214.

Loc. Alton, Illinois.

CAMAROSPIRA Hall and Clarke.

Genotype Camarophoria eucharis Hall.

Camarospira Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 82;—Thirteenth Ann. Rep. New York State Geologist, 1895, p. 776.

Camarospira eucharis Hall. Corniferous (Dev.).

Camarophoria eucharis Hall, Pal. New York, IV, 1867, p. 368, pl. 57, figs. 40–45.

Camarospira eucharis Hall and Clarke, Ibidem, VIII, Pt. II, 1893, p. 82, pl. 50, figs. 46–52.

Loc. Ontario, Canada; Cass County, Indiana.

CAMAROTŒCHIA Hall and Clarke.

Genotype Atrypa congregata Conrad.

Camarotœchia Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 189;—Thirteenth Ann. Rep. New York State Geologist, 1895, p. 826.

Camarotœchia(?) acinus Hall. Niagara (Sil.).

Rhynchonella acinus Hall, Trans. Albany Institute, IV, 1863, p. 215;—Twenty-eighth Rep. New York State Mus. Nat. Hist, 1879, p. 163, pl. 26, figs. 7–11;—Eleventh Rep. State Geol. Indiana, 1882, p. 306, pl. 26, figs. 7–11.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 73, pl. 26, figs. 6, 13, 14, and pl. 32, figs. 13–16.—Beecher and Clarke, Mem. New York State Mus., I, 1889, p. 35, pl. 4, figs. 9–11.

Camarotœchia? acinus Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 190.

Loc. Waldron, Indiana; Louisville, Kentucky.

Camarotœchia(?) acinus convexa (Foerste). Clinton (Sil.).

Rhynchonella acinus var. convexa Foerste, Proc. Boston Soc. Nat. Hist., XXIV, 1890, p. 318, pl. 6, fig. 13;—Geol. Ohio, VII, 1895, p. 593, pl. 31, fig. 13.

Loc. Hanover, Indiana.

Camarotœchia æquiradiata Hall. Clinton (Sil.).

Atrypa equiradiata Hall, Pal. New York, II, 1852, p. 70, pl. 23, fig. 5.

Rhynchospira? equiradiata Hall, Twelfth Rep. New York State Cab. Nat. Hist., 1859, p. 77.

Rhynchonella æquiradiata Miller, N. American Geol. Pal., 1889, p. 367.

Camarotœchia æquiradiata Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 190.

Protorhyncha æquiradiata Hall and Clarke, Ibidem, 1895, pl. 56, figs. 7–9.

Loc. Oneida County, New York; Arisaig, Nova Scotia.

Camarotœchia (Plethorhyncha) barrandei Hall. Oriskany (Dev.).

Rhynchonella barrandi Hall, Tenth Rep. New York State Cab. Nat. Hist., 1857, p. 82, figs. 1–3; p. 84, fig. 4;—Pal. New York, III, 1859, p. 442, pl. 103, figs. 3–8.

Plethorhyncha barrandi Hall and Clarke, Ibidem, VIII, Pt. II, 1893, p. 191.

Loc. Albany and Schoharie counties, New York.

Camarotœchia billingsi Hall. Corniferous (Dev.).

Rhynchonella thalia Billings (non d'Orbigny, 1847), Canadian Jour., V, 1860, p. 272, figs. 23–25;—Geol. Canada, 1863, p. 370, fig. 386.

Rhynchonella (Stenocisma) billingsi Hall, Pal. New York, IV, 1867, p. 336, pl. *54, figs. 9–13.*

Camarotœchia billingsi Hall—Continued.

Camarotœchia billingsi Hall and Clarke, Ibidem, VIII, Pt. II, 1893, p. 192, pl. 57, fig. 3.

Loc. New York; Columbus, Ohio; Ontario.

Camarotœchia carica Hall. Hamilton (Dev.).

Rhynchonella (Stenocisma) carica Hall, Pal. New York, IV, 1867, p. 344, pl. 54A, figs. 21–23.

Camarotœchia carica Hall and Clarke, Ibidem, VIII, Pt. II, 1893, p. 192.

Loc. Hamilton, Madison County, New York.

Camarotœchia carolina Hall. Corniferous (Dev.).

Rhynchonella (Stenocisma) carolina Hall, Pal. New York, IV, 1867, p. 337, pl. 34, figs. 14–19.

Rhynchonella carolina Meek, Pal. Ohio, I, 1873, p. 196, pl. 18, fig. 8.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 75, pl. 13, figs. 1–3, 34, 35.

Camarotœchia carolina Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 192, pl. 57, figs. 4–6.

Loc. Columbus and Sandusky, Ohio; Falls of Ohio.

Camarotœchia congregata (Conrad). Hamilton (Dev.).

Atrypa congregata Conrad, Fifth Ann. Rep. New York Geol. Survey, 1841, p. 55.

Rhynchonella (Stenocisma) congregata Hall, Pal. New York, IV, 1867, p. 341, pl. 54, figs. 44–59.

Camarotœchia congregata Hall and Clarke, Ibidem, VIII, Pt. II, 1893, p. 192, pl. 57, figs. 15–27.

Loc. Fultonham, Summit, Onondaga, and Tinkers Falls, New York.

Camarotœchia contracta Hall. Portage-Waverly (Dev.-L. Carb.).

Atrypa contracta Hall, Geol. New York; Rep. Fourth Dist., 1843, tab. 66, figs. 2, 3.

Atrypa laticostata Hall (non Phillips), Ibidem, 1843, tab. 66, fig. 1.

Rhynchonella (Stenocisma) contracta Hall, Pal. New York, IV, 1867, p. 351, pl. 55, figs. 26–39.

Rhynchonella contracta Herrick, Bull. Denison Univ., III, 1887, p. 39, pl. 10, fig. 9;—Ibidem, IV, 1888, p. 23, pl. 11, fig. 21.

Camarotœchia contracta Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 192, pl. 57, figs. 28–32, 49.

Loc. New York; Meadville and Bradford, Pennsylvania; Licking County, Ohio.

Camarotœchia contracta saxatilis (Hall). Hamilton (Dev.).

Rhynchonella (Stenocisma) saxatilis Hall, Pal. New York, IV, 1867, p. 417, pl. 54A, figs. 44–51.

Loc. Rockford, Iowa.

Camarotœchia dotis Hall. Marcellus and Hamilton (Dev.).

Rhynchonella (Stenocisma) dotis Hall, Pal. New York, IV, 1867, p. 344, pl. 54A, figs. 11–20.—Rathbun, Bull. Buffalo Soc. Nat. Sci., I, 1874, p. 246, pl. 8, figs. 10, 12;—Proc. Boston Soc. Nat. Hist., XX, 1879, p. 33.

Camarotœchia dotis Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 192, pl. 57, figs. 40, 41.

Loc. Geneseo and York, New York; Columbus, Ohio; Rio Maecuru and R^o Curua and Erere, Brazil.

Camarotœchia(?) duplicata Hall. Chemung (Dev.).

Atrypa duplicata Hall, Geol. New York; Rep. Fourth Dist., 1843, tab. 67, fig. 2.

Rhynchonella (Stenocisma) duplicata Hall, Pal. New York, IV, 1867, p. 350, pl. 55, figs. 17–25.

Camarotœchia (?) duplicata Hall—Continued.

Rhynchonella duplicata Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 155, pl. 14, fig. 8.

Camarotœchia (?) duplicata Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 192, pl. 57, figs. 36–39.

Loc. New York; Eureka district, Nevada.

Camarotœchia (Plethorhyncha) endlichi (Meek). ?Devonian.

Rhynchonella endlichi Meek, Bull. U. S. Geol. Survey Terr., 2d ser., 1, 1875, p. 46.—White, Twelfth Ann. Rep. U. S. Geol. Survey Terr., 1883, p. 133, pl. 36, fig. 2; pl. 33, fig. 4.

Loc. East of Animas River, Colorado.

Obs. This type of Rhynchonella occurs in eastern North America only in the Lower Devonian. It therefore seems probable that Meek's provisional reference to the Devonian is nearer correct than White's to the Lower Carboniferous.

Camarotœchia eximia Hall. Portage-Chemung (Dev.).

Atrypa eximia Hall, Geol. New York; Rep. Fourth Dist., 1843, tab. 66, fig. 4.—Rogers, Geol. Pennsylvania, II, Pt. II, 1858, p. 829, fig. 682.

Rhynchonella (Stenocisma) eximia Hall, Pal. New York, IV, 1867, p. 348, pl. 55, figs. 1–8.—Kindle, Bull. American Pal., 6, 1896, p. 36.

Camarotœchia eximia Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 192, pl. 57, figs. 44, 45.

Loc. Ithaca, New York; Pennsylvania.

Camarotœchia fringilla (Billings). Anticosti (Sil.).

Rhynchonella fringilla Billings, Pal. Fossils, I, 1862, p. 141, fig. 118.

Camarotœchia fringilla Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 190, pl. 56, figs. 28–30.

Loc. Anticosti.

Camarotœchia glacialis (Billings). Anticosti (Sil.).

Rhynchonella glacialis Billings, Pal. Fossils, I, 1862, p. 143, fig. 120.

Camarotœchia glacialis Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 190.

Loc. Anticosti.

Camarotœchia horsfordi Hall. Marcellus and Hamilton (Dev.).

Rhynchonella horsfordi Hall, Thirteenth Rep. New York State Cab. Nat. Hist., 1860, p. 87.—Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 152, pl. 14, fig. 3; pl. 15, fig. 6.

Rhynchonella (Stenocisma) horsfordi Hall, Pal. New York, IV, 1867, p. 339, pl. 54, figs. 24–32.

Camarotœchia horsfordi, Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 192, pl. 57, figs. 7–9.

Loc. Moscow, York, Geneseo, and Avon, New York; Eureka district, Nevada.

Camarotœchia(?) indianensis (Hall). Niagara (Sil.).

Rhynchonella indianensis Hall, Trans. Albany Institute, IV, 1863, p. 215;—Twenty-eighth Rep. New York State Mus. Nat. Hist., 1879, p. 163, pl. 26, figs. 12–22;—Eleventh Rep. State Geol. Indiana, 1882, p. 306, pl. 26, figs. 12–22; pl. 27, figs. 4–6.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 76, pl. 33, figs. 18–20.—Beecher and Clarke, Mem. New York State Mus., I, 1889, p. 42, pl. 3, figs. 17–28.

Loc. Waldron, Indiana; Louisville, Kentucky.

Camarotœchia marshallensis (A. Winchell). Marshall (L. Carb.).

Rhynchonella marshallensis A. Winchell, Proc. Acad. Nat. Sci. Philadelphia, 1862, p. 408.—Herrick, Bull. Denison Univ, III, 1888, p. 40; IV, p. 23;—Geol. Ohio, VII, 1895, pl. 23, fig. 14.

Camarotœchia marshallensis (A. Winchell)—Continued.

Camarotœchia marshallensis Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 192.

Loc. Marshall, Michigan; Granville, etc., Ohio.

Camarotœchia(?) neglecta Hall. Clinton and Niagara (Sil.).

Atrypa neglecta Hall, Pal. New York, II, 1852, p. 70, pl. 23, fig. 4; p. 274, pl. 57, fig. 1.—Billings, Canadian Nat. Geol., I, 1856, p. 138, pl. 2, figs. 11, 12.

Rhynchonella neglecta Hall, Twelfth Rep. New York State Cab. Nat. Hist., 1859, p. 78.—Billings, Geology Canada, 1863, p. 315, fig. 325.—Meek, Pal. Ohio, I, 1873, p. 179, pl. 15, fig. 3.—Hall and Whitfield, Ibidem, II, 1875, p. 134, pl. 7, fig. 15.—Hall, Twenty-eighth Rep. New York State Mus. Nat. Hist., 1879, p. 162, pl. 26, figs. 1-6;—Eleventh Rep. State Geol. Indiana, 1882, p. 305, pl. 26, figs. 1-6; pl. 27, fig. 3.—Beecher and Clarke, Mem. New York State Mus., I, 1889, p. 37, pl. 4, figs. 3, 6-8.—Foerste, Proc. Boston Soc. Nat. Hist., XXIV, 1890, p. 317, pl. 6, fig. 12.

Rhynchonella neglecta var. scobina Meek, American Jour. Sci., 3d ser., IV, 1872, p. 277.

Rhynchonella scobina Hall and Whitfield, Pal. Ohio, II, 1875, p. 116.—Foerste, Geol. Ohio, VII, 1895, p. 592.

Camarotœchia? neglecta Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 190.

Loc. Reynales Basin, Lockport, etc., New York; Hamilton, Ontario; Dayton and Cedarville, Ohio; Hanover, Indiana; Wisconsin; Arisaig, Nova Scotia.

Camarotœchia obtusiplicata Hall. Niagara (Sil.).

Atrypa obtusiplicata Hall, Pal. New York, II, 1852, p. 279, pl. 58, fig. 2.

Rhynchonella obtusiplicata Hall, Twelfth Rep. New York State Cab. Nat. Hist., 1859, p. 78.

Camarotœchia obtusiplicata Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 190.

Loc. Lockport, New York.

Camarotœchia orbicularis Hall. Chemung (Dev.).

Rhynchonella orbicularis Hall, Thirteenth Rep. New York State Cab. Nat. Hist., 1860, p. 88.

Rhynchonella (Stenocisma) orbicularis Hall, Pal. New York, IV, 1867, p. 353, pl. 55, figs. 40-46.

Camarotœchia orbicularis Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 192, pl. 57, figs. 46-48, 50.

Loc. Chautauqua County, New York; Meadville, Pennsylvania.

Camarotœchia plena Hall. Chazy (Ord.).

Atrypa plena Hall, Pal. New York, I, 1847, p. 21, pl. 4 bis, fig. 7.—Billings, Canadian Nat. Geol., I, 1856, p. 207, figs. 17-19.—Rogers, Geol. Pennsylvania, II, Pt. II, 1858, p. 817, fig. 592.

Atrypa plicifera Hall, Pal. New York, I, 1847, p. 22, pl. 4 bis, fig. 8.

Atrypa altilis Hall, Ibidem, 1847, p. 23, pl. 4 bis, fig. 9.

Rhynchonella plena, plicifera, and altilis Hall, Twelfth Rep. New York State Cab. Nat. Hist., 1859, pp. 65, 66.

Rhynchonella plena Billings, Canadian Nat. Geol., IV, 1859, p. 444, fig. 22;—Geol. Canada, 1863, p. 126, fig. 50.

Camarotœchia plena and altilis Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 190.

Loc. Chazy, New York; Montreal and Ottawa, Canada.

Camarotœchia (Plethorhyncha) pleiopleura (Conrad). Oriskany (Dev.).

Atrypa pleiopleura Conrad, Fifth Ann. Rep. Geol. Survey New York, 1841, p. 55.

Rhynchonella pleiopleura Hall, Tenth Rep. New York State Cab. Nat. Hist., 1857, p. 86, figs. 1-4;—Pal. New York, III, 1859, p. 440, pl. 102, figs. 3, 4.—Billings, Pal. Fossils, *II, 1874, p. 38, figs. 19, 20.*

Camarotœchia (Plethorhyncha) pleiopleura (Conrad)—Continued.

Plethorhyncha pliopleura Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 191.

Loc. Albany and Schoharie counties, New York; Indian Cove, Gaspé.

Camarotœchia prolifica Hall. Marcellus and Hamilton (Dev.).

Rhynchonella (Stenocisma) prolifica Hall, Pal. New York, IV, 1867, p. 343, pl. 54A, figs. 1–10.

Rhynchonella prolifica Tschernyschew, Mém. du Comité Géol. St. Petersburg, III, 1887, p. 89, pl. 14, fig. 6.

Camarotœchia prolifica Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 192, pl. 57, figs. 42, 43.

Loc. Fultonham and Cooperstown, New York; Russia.

Camarotœchia sageriana (A. Winchell). Marshall (L. Carb.).

Rhynchonella sageriana A. Winchell, Proc. Acad. Nat. Sci. Philadelphia, 1862, p. 407;—Ibidem, 1865, p. 122.—Herrick, Bull. Denison Univ., III, 1888, p. 39.

Camarotœchia sageriana Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 192.

Loc. Marshall, Michigan; Weymouth, Ashland, Sciotoville, and Newark, Ohio; Hickman County, Tennessee.

Camarotœchia sappho Hall. Marcellus-Waverly (Dev.-L. Carb.).

Rhynchonella sappho Hall, Thirteenth Rep. New York State Cab. Nat. Hist., 1860, p. 87.—Herrick, Bull. Denison Univ., III, 1888, p. 40, pl. 5, fig. 1; pl. 7, fig. 25;—Geol. Ohio, VII, 1895, pl. 21, fig. 1.

Rhynchonella (Stenocisma) sappho Hall, Pal. New York, IV, 1867, p. 340, pl. 54, figs. 33–43; var. pl. 55, figs. 47–52.

Camarotœchia sappho Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 192, pl. 57, figs. 10–14.

Loc. Leroy, Geneseo, and York, New York; Licking County, Ohio.

Camarotœchia (Plethorhyncha) speciosa (Hall). Oriskany (Dev.).

Rhynchonella speciosa Hall, Tenth Rep. New York State Cab. Nat. Hist., 1857, p. 81;—Pal. New York, III, 1859, p. 444, pl. 103A, figs. 1–6.—Meek and Worthen, Geol. Survey Illinois, III, 1868, p. 394, pl. 8, fig. 9.

Rhynchotrema speciosa Waagen, Palæontologica Indica, Ser. XIII, I, 1883, p. 411.

Plethorhyncha speciosa Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 191, pl. 58, figs. 29–37.

Loc. Cumberland, Maryland; Jackson County, Illinois.

Camarotœchia stephani Hall. Portage and Chemung (Dev.).

Rhynchonella (Stenocisma) stephani Hall, Pal. New York, IV, 1867, p. 349, pl. 55, figs. 9–16.

Camarotœchia stephani Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 192;—Ibidem, 1895, pl. 57, figs. 33–35.

Loc. Ithaca and Phillipsburg, New York; Bradford, Pennsylvania.

Camarotœchia tethys (Billings). Corniferous (Dev.).

Rhynchonella? tethys Billings, Canadian Jour., V, 1860, p. 270, figs. 20–22.

Rhynchonella tethys Billings, Geol. Canada, 1863, p. 370, fig. 387.—Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 152.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 83, pl. 13, figs. 25–33; pl. 31, figs. 22–25.

Rhynchonella (Stenocisma) tethys Hall, Pal. New York, IV, 1867, p. 335, pl. 54, figs. 1–8.

Camarotœchia tethys Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 192, pl. 57, figs. 1, 2.

Loc. County of Haldimand, Ontario; Stafford and Williamsville, New York; *Columbus, Ohio;* Falls of Ohio; Eureka district, Nevada.

Camarotœchia ventricosa Hall. Lower Helderberg (Dev.).

Rhynchonella ventricosa Hall, Tenth Rep. New York State Cab. Nat. Hist., 1857, p. 78, figs. 1-6;—Pal. New York, III, 1859, p. 238, pl. 43, fig. 1.

Camarotœchia ventricosa Hall and Clarke, Ibidem, VIII, Pt. II, 1893, p. 191.

Wilsonia ventricosa Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 58, figs. 13, 14.

Loc. Schoharie, Carlisle, and Cherry Valley, New York.

Camarotœchia whitei Hall. Niagara (Sil.).

Rhynchonella whitii Hall (non A. Winchell), Trans. Albany Institute, IV, 1863, p. 216.

Rhynchonella whitii Hall, Twenty-eighth Rep. New York State Mus. Nat. Hist., 1879, p. 164, pl. 26, figs. 23-33;—Eleventh Rep. State Geol. Indiana, 1882, p. 307, pl. 26, figs. 23-33.—Beecher and Clarke, Mem. New York State Mus., I, 1889, p. 39, pl. 4, figs. 1, 2, 4, 5.

Rhynchonella whitiana Miller, American Pal. Fossils, 2d ed., 1883, p. 297.

Camarotœchia? whitii Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 190.

Loc. Waldron and Osgood, Indiana.

Capulus lugubris Conrad=Discinisca lugubris.

CAPELLINIA Hall and Clarke. Genotype C. mira H. and C.

Capellinia Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 248, pl. 70, figs. 6-14;—Thirteenth Ann. Rep. New York State Geologist, 1895, p. 847.

Capellinia mira Hall and Clarke. Niagara (Sil.).

Capellinia mira Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 249, pl. 70, figs. 6-14.

Loc. Vicinity of Milwaukee, Wisconsin.

CATAZYGA Hall and Clarke. Genotype Athyris headi Billings.

Catazyga Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 157, fig. 151;—Thirteenth Ann. Rep. New York State Geologist, 1895, p. 803.

Catazyga erratica Hall. Lorraine (Ord.).

Orthis? erratica Hall, Pal. New York, I, 1847, p. 288, pl. 79, fig. 5.

Athyris headi var. anticostiensis Billings, Pal. Fossils, I, 1862, p. 147, fig. 127.

Athyris headi var. borealis, Billings, Ibidem, 1862, p. 147, fig. 126.

Athyris borealis Billings, Geol. Canada, 1863, p. 212, fig. 216.

Athyris anticostiensis Billings, Ibidem, 1863, p. 212, fig. 215.

Zygospira anticostiensis Davidson, Suppl. British Sil. Brach., Palæontographical Soc., 1882, p. 127.

Zygospira erratica Davidson, Ibidem, 1882, p. 126.

Orthis erratica, var. Keesow, Ueber Sil. u. Devon. geschiebe Westpreussens, 1884, p. 246, pl. 2, fig. 10.

Catazyga headi vars. borealis and anticostiensis Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 54, figs. 27, 31-34.

Catazyga erratica Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 158, pl. 54, figs. 17-23.

Loc. Oswego County, New York; River Saguenay, Lake St. John, Canada; Anticosti; "Wesenberg Schict," Prussia.

Catazyga headi (Billings). Lorraine (Ord.).

Athyris headi Billings, Pal. Fossils, I, 1862, p. 147, fig. 125;—Geol. Canada, 1863, p. 212, fig. 214.

Zygospira headi Hall, Twenty-third Rep. New York State Cab. Nat. Hist., 1872, pl. 13, figs. 23-25 (extract pub. 1871).—Meek, Pal. Ohio, I, 1873, p. 127, pl. 11, fig. 1.—Miller, Cincinnati Quart. Jour. Sci., II, 1875, p. 59.—Davidson, Suppl. British Sil. Brach., Palæontographical Soc., 1882, p. 125.

Glassia schuchertana Ulrich, American Geologist, I, 1888, p. 186.

Glassia headi *Miller, N. American Geol. Pal.*, 1889, p. 346.

Catazyga headi (Billings)—Continued.

Catazyga headi Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 158, fig. 151; pl. 54, figs. 24–26, 30.

Loc. St. Lawrence River, opposite Three Rivers; near St. Nicholas, St. Croix, and Becancour River, Quebec, Canada; Waynesville, etc., Ohio; Richmond and Versailles, Indiana. According to Mr. Ami, also in the Utica slate at Ottawa, Canada.

Catazyga uphami (Winchell and Schuchert). Trenton (Ord.).

Zygospira uphami Winchell and Schuchert, American Geol., IX, 1892, p. 291;—Minnesota Geol. Survey, III, p. 468, pl. 34, figs. 45–48.

Loc. Near Spring Valley and Wykoff, Minnesota.

CENTRONELLA Billings. Genotype Rhynchonella glansfagea Hall.

Centronella Billings, Canadian Nat Geol., IV, 1859, p. 131, figs. 1-5;—Canadian Jour., VI, 1861, p. 271.—Hall, Sixteenth Rep. New York State Cab. Nat. Hist., 1863, p. 45, figs. 13–17;—American Jour. Sci., 2d ser., XXXV, 1863, p. 396.—Billings, Ibidem, XXXVI, 1863, p. 237.—Hall, Trans. Albany Institute, IV, 1863, pp. 134, 148.—A. Winchell, Proc. Acad. Nat. Sci. Philadelphia, 1865, p. 122.—Hall, Pal. New York, IV, 1867, p. 399.—Hall and Clarke, Ibidem, VIII, Pt. II, 1893, p. 265;—Thirteenth Ann. Rep. New York State Geologist, 1895, p. 853.

Centronella(?) allei A. Winchell. Waverly (L. Carb.).

Centronella allii A. Winchell, Proc. Acad. Nat. Sci. Philadelphia, 1865, p. 123.

Cryptonella? allei Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 290.

Loc. Burlington, Iowa; Hamburg, Illinois; Summit County, Ohio.

Centronella alveata Hall. Onondaga (Dev.).

Rhynchonella? alveata Hall, Tenth Rep. New York State Cab. Nat. Hist., 1857, p. 124.

Centronella hecate Billings, Canadian Jour., VI, (May) 1861, p. 272, fig. 99;—Geol. Canada, 1863, p. 374, fig. 403.—Hall, Pal. New York, IV, 1867, p. 420, pl. 61A, figs. 27–29.—Ibidem, VIII, Pt. II, 1895, pl. 79, fig. 15.

Centronella alveata Hall, Pal. New York, IV, 1867, p. 401, pl. 61A, figs. 22–24.—Hall and Clarke, Ibidem, VIII, Pt. II, 1893, p. 268, pl. 79, figs. 22–24.

Loc. New York; Cayuga, Ontario.

Obs. See C. impressa Hall.

Centronella anna Hartt=Harttina anna.

Centronella(?) arcei A. Ulrich. Devonian.

Centronella? arcei Ulrich, N. Yahrb. f. Mineral., Beilageband, VIII, 1892, p. 53, pl. 5, figs. 5–9.

Loc. Icla, and near Pulquina, Bolivia.

Centronella billingsiana Meek and Worthen=Whitfieldella billingsiana.

Centronella(??) crassicardinalis Whitfield. Warsaw (L. Carb.).

Centronella crassicardinalis Whitfield, Bull. American Mus. Nat. Hist., I, 1882, p. 55, pl. 6, figs. 50–52.—Hall, Twelfth Rep. State Geol. Indiana, XXIX, 1883, figs. 50–52.

Loc. Spergen Hill, Indiana.

Obs. This species is not well established and is based upon a single ventral valve. Compare with Athyris densa.

Centronella(?) flora A. Winchell. Waverly (L. Carb.).

Centronella? flora A. Winchell, Proc. American Phil. Soc., XII, 1870, p. 254.

Loc. Sciotoville, Ohio.

Centronella glansfagea Hall. Oriskany-Corniferous (Dev.).

Rhynchonella glansfagea Hall, Tenth Rep. New York State Cab. Nat. Hist., 1857, p. 125, figs. 1–6.

Centronella glansfagea Billings, Canadian Nat. Geol., IV, 1859, p. 132, figs. 1–5;—Canadian Jour., VI, 1861, p. 271, fig. 97;—Geol. Canada, 1863, p. 374, fig. 405.—Hall, Sixteenth Rep. New York State Cab. Nat. Hist., 1863, pp. 45–47;—Pal. New York, IV, 1867, p. 399, pl. 61A, figs. 1–21, 25, 26.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 153, pl. 31, figs. 14–17.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 268, fig. 180; 180; pl. 79, figs. 1–14, 17, 21.

Loc. Albany and Schoharie counties, New York; Cayuga, Ontario; Falls of Ohio; Michigan.

Obs. In the American Museum of Natural History this species is labeled Atrypa naviculoides Conrad. The writer has not been able to find this description. It may be one of Conrad's manuscript names.

Centronella glaucia Hall. Hamilton (Dev.).

Centronella glaucia Hall, Pal. New York, IV, 1867, p. 403, pl. 61A, figs. 39, 40.—Hall and Clarke, Ibidem, VIII, Pt. II, 1893, p. 269.

Loc. Schoharie, New York.

Centronella hecate Billings=C. alveata.

Centronella impressa Hall. Hamilton (Dev.).

Centronella impressa Hall, Fourteenth Rep. New York State Cab. Nat. Hist., (July or August) 1861, p. 102;—Fifteenth Rep., Ibidem, 1862, pl. 3, figs. 1–5.—Billings, Canadian Nat. Geol., VII, 1862, p. 392.—Hall, Pal. New York, IV, 1867, p. 402, pl. 61A, figs. 30–38.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 269, pl. 79, figs. 16, 18–20.

Loc. Bellona, York, Pavilion, and Hamburg, New York.

Obs. Billings says this species is the same as C. hecate (=C. alveata).

Centronella julia A. Winchell=Romingerina julia.

Centronella margarida Derby=Trigeria margarida.

Centronella (?) navicella Hall. Chemung (Dev.).

Terebratula navicella Hall, Pal. New York, IV, 1867, p. 391, pl. 60, figs. 38–44.

Centronella (?) navicella Hall and Clarke, Ibidem, VIII, Pt. II, 1895, pl. 79, figs. 40–42.

Loc. Rockford, Iowa.

Centronella ovata Hall. Upper Helderberg (Dev.).

Centronella ovata Hall, Pal. New York, IV, 1867, p. 419, pl. 61A, figs. 47–49.

Loc. Cayuga, Ontario.

Centronella(?) silvetii A. Ulrich. Devonian.

Centronella silvetii A. Ulrich, N. Jahrb. f. Mineral., Beilageband, VIII, 1892, p. 51, pl. 4, figs. 15a–15d.

Loc. Chahuarani, Bolivia.

Centronella tumida Billings. Oriskany and Corniferous (Dev.).

Centronella tumida Billings, Canadian Jour., VI, 1861, p. 272, fig. 98;—Geol. Canada, 1863, p. 374, fig. 404.

Loc. Cayuga and Port Colbourne, Ontario.

CHARIONELLA Billings. Genotype Atrypa scitula Hall.

Charionella Billings, Canadian Jour., VI, 1861, pp. 148, 274, figs. 101, 102.—Hall, Sixteenth Rep. New York State Cab. Nat Hist., 1863, p. 40;—American Jour. Sci., n. ser., XXXV, 1863, p. 396.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 78;—Thirteenth Rep. New York State Geologist, 1895, p. 775.

Charionella circe Billings=C. scitula.
Charionella doris Billings=Meristella doris.
Charionella hyale Billings=Whitfieldella hyale.
Charionella rostrata Billings=Meristella rostrata.

Charionella scitula Hall. Corniferous (Dev.).

Atrypa scitula Hall, Geol. New York; Rep. Fourth Dist., 1843, p. 171, fig. 1.
Athyris? scitula Billings, Canadian Jour., V, 1860, p. 278, figs. 35–38.
Charionella circe Billings, Ibidem, VI, 1861, p. 273, fig. 100;—Geol. Canada, 1863, p. 374, fig. 400.
Meristella scitula Hall, Pal. New York, IV, 1867, p. 302, pl. 47, figs. 34–38.
Meristella circe Miller, N. American Geol. Pal., 1889, p. 354.
Charionella scitula Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 78, pl. 42, figs. 17–19.
Loc. Williamsville and Clarence Hollow, New York; Columbus, Ohio (Whitfield); county of Haldimand, Ontario.

CHONETES Fischer de Waldheim. Genotype Orthis striatella Dalman.

Chonetes Fischer de Waldheim, Oryctographie du Gouvernement de Moscow, Pt. II, 1837, p. 134.—Hall, Pal. New York, II, 1852, p. 64.—Billings, Canadian Jour., VI, 1861, p. 349.—Meek and Hayden, Pal. Upper Missouri, Smithsonian Cont. Knowl., 172, 1864, p. 22.—Hall, Twentieth Rep. New York State Cab. Nat. Hist., 1867, p. 242;—Pal. New York, IV, 1867, p. 115.—Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 122.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1886, p. 66.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 303;—Eleventh Ann. Rep. New York State Geologist, 1894, p. 292.

Chonetes acutiradiatus Hall. Corniferous (Dev.).

Strophomena acutiradiata Hall, Geol. New York; Rep. Fourth Dist., 1843, p. 171, fig. 3.
Chonetes acutiradiata Hall, Tenth Rep. New York State Cab. Nat. Hist., 1857, p. 117;—Pal. New York, IV, 1867, p. 120, pl. 20, fig. 5;—Second Ann. Rep. New York State Geol., 1883, pl. 47, fig. 8.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 66, pl. 18, figs. 18–20.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 16, fig. 8.
Loc. Williamsville, Stafford, etc., New York; Columbus, Ohio; Falls of Ohio.

Chonetes amazonicus Derby. Upper Carboniferous.

Chonetes amazonica Derby, Bull. Cornell Univ., I, 1874, p. 41, pl. 6, figs. 3, 12, 19; pl. 9, figs. 8, 9.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 15B, fig. 13.
Loc. Itaituba, Brazil.

Chonetes antiope Billings. Lower Devonian.

Chonetes anitope Billings, Pal. Fossils, II, 1874, p. 19.
Loc. Mount Jolli and Percé, Nova Scotia.

Chonetes arcei A. Ulrich. Middle Devonian.

Chonetes arcei A. Ulrich, N. Jahrb. f. Mineral., Beilageband VIII, 1892, p. 77, pl. 4, figs. 35, 36.
Loc. Chahuarani, Icla, and Tarabuco, Bolivia.

Chonetes arcuatus Hall. Corniferous (Dev.).

Chonetes arcuata Hall, Tenth Rep. New York State Cab. Nat. Hist., 1857, p. 116;—Pal. New York, IV, 1867, p. 119, pl. 20, fig. 7;—Second Ann. Rep. New York State Geol., 1883, pl. 47, figs. 15, 35, 36.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 16, figs. 15, 35, 36.
Loc. Williamsville, Clarence Hollow, etc., New York; Columbus, Ohio.

Chonetes armata Norwood and Pratten (non Bouchard)=C. pusilus.

Chonetes canadensis Billings. Lower Devonian.

Chonetes canadensis Billings, Pal. Fossils, II, 1874, p. 17, fig. 7.
Loc. Percé, Nova Scotia.

Chonetes complanata Hall=Chonostrophia complanata.

Chonetes comstockei Rathbun. Middle Devonian.

Chonetes comstockii Rathbun, Bull. Buffalo Soc. Nat. Sci., I, 1874, p. 250, pl. 9, figs. 5, 14, 18, 19, 31;—Proc. Boston Soc. Nat. Hist., XX, 1879, p. 18.
Loc. Province of Para, Brazil.

Chonetes cornutus (Hall). Clinton (Sil.).

Strophomena cornuta Hall, Geol. New York; Rep. Fourth Dist., 1843, p. 73, fig. 3.
Chonetes cornuta de Koninck, Recher. Animaux Foss., Pt. I, 1847, p. 200, pl. 20, fig. 3.—Hall, Pal. New York, II, 1852, p. 64, pl. 21, fig. 10;—Second Ann. Rep. New York State Geol., 1883, pl. 47, fig. 1.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 16, fig. 1.
Loc. Wayne County, New York.

Chonetes coronatus (Conrad). Hamilton (Dev.).

Strophomena carinata Conrad, Jour. Acad. Nat. Sci. Philadelphia, VIII, 1842, p. 257, pl. 14, fig. 13.
Strophomena syrtalis Conrad, Ibidem, 1842, p. 253, pl. 14, fig. 1.
Chonetes littoni Norwood and Pratten, Jour. Acad. Nat. Sci. Philadelphia, III, 1854, p. 25, pl. 2, fig. 4.
Chonetes maclurea Norwood and Pratten, Ibidem, 1854, p. 28, pl. 2, fig. 8.
Chonetes tuomyi Norwood and Pratten, Ibidem, 1854, p. 28, pl. 2, fig. 9.
Chonetes martini Norwood and Pratten, Ibidem, 1854, p. 29, pl. 2, fig. 10.
Chonetes coronata Hall, Tenth Rep. New York State Cab. Nat. Hist., 1857, p. 146, figs. 1, 2;—Pal. New York, IV, 1867, p. 133, pl. 21, figs. 9-12.—Whitfield, Geol. Wisconsin, IV, 1882, p. 327, pl. 25, fig. 16.—Hall, Second Ann. Rep. New York State Geol., 1883, pl. 47, figs. 10, 11, 24, 26, 33, 39, 41, 43.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 16, figs. 10, 11, 24, 26, 33, 39, 41, 43.
Loc. New York; Pennsylvania; near Arkona, Ontario; Bakeoven, Illinois; Milwaukee, Wisconsin.
Obs. In the Illinois State collection there are specimens of C. maclurea and C. littoni which are not specifically distinct from C. coronatus Conrad. In the American Museum of Natural History the writer has seen specimens of C. tuomyi and C. martini labeled as varieties of C. coronatus.

Chonetes curuaensis Rathbun. Middle Devonian.

Chonetes curuaensis Rathbun, Proc. Boston Soc. Nat. Sci., XX, 1879, p. 21.
Loc. Province of Para, Brazil.

Chonetes dawsoni Billings=Chonostrophia dawsoni.

Chonetes deflecta Hall=C. vicinus.

Chonetes emmetensis A. Winchell. Hamilton (Dev.).

Chonetes emmetensis A. Winchell, Rep. Lower Peninsula Michigan, 1866, p. 92.
Loc. Grand Traverse Region, Michigan.

Chonetes falklandicus Morris and Sharpe. Lower Devonian.

Chonetes falklandica Morris and Sharpe, Quart. Jour. Geol. Soc. London, II, 1846, p. 274, pl. 10, fig. 4.—De Koninck, Recher. Animaux Foss., Pt. I, 1847, p. 204, pl. 20, fig. 4.—Von Ammon, Zeits. d. Gessels. für Erdk., Berlin, XXVIII, 1893, p. 360, fig. 5.
Loc. Falkland Islands; Taquarassu, Matto Grosso, Brazil.

Chonetes filistriatus Walcott. Lower Devonian.

Chonetes filistriata Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 127, pl. 13, fig. 15.

Loc. Eureka district, Nevada.

Chonetes fischeri Hall=Chonopectus fischeri.

Chonetes flemingi Norwood and Pratten=C. variolatus.

Chonetes freitassii Rathbun. Middle Devonian.

Chonetes species Rathbun, Bull. Buffalo Soc. Nat. Sci., I, 1874, p. 253.

Chonetes freitassii Rathbun, Proc. Boston Soc. Nat. Hist., XX, 1879, p. 18.

Loc. Province of Para, Brazil.

Chonetes geinitziana Waagen, and Miller=C. glaber.

Chonetes geniculatus White. Kinderhook (L. Carb.).

Chonetes geniculata White, Proc. Boston Soc. Nat. Hist., IX, 1862, p. 29.—A. Winchell, Proc. Acad. Nat. Sci. Philadelphia, 1865, p. 116;—Proc. American Phil. Soc., XI, 1870, p. 250.

Chonetes geniculatus Keyes, Geol. Survey Missouri, V, 1895, p. 53, pl. 38, fig. 3.

Loc. Hamburg, Illinois; Clarksville, Missouri; Rockford, Indiana; Rockville, Ohio.

Obs. Compare with C. ornatus Shumard.

Chonetes gibbosa Hall=C. vicinus.

Chonetes glabra Hall (non Geinitz)=C. lineatus.

Chonetes glaber Geinitz. Upper Carboniferous.

Chonetes glabra Geinitz, Carbon u. Dyas in Nebraska, 1866, p. 60, pl. 4, figs. 15–18.—Toula, Sitzb. der Kais. Akad. der Wissensch., Wien, LIX, 1869, p. 10.—Meek, Final Rep. U. S. Geol. Survey Nebraska, 1872, p. 171, pl. 4, fig. 10; pl. 8, fig. 8.—Derby, Bull. Cornell Univ., 1, 1874, p. 43, pl. 8, figs. 11, 14, 15, 19;—Bull. Mus. Comp. Zool., III, 1876, p. 280.

Chonetes geinitziana Waagen, Palæontologica Indica, Ser. XIII, I, 1884, p. 621.

Chonetes lævis Keyes, Proc. Acad. Nat. Sci. Philadelphia, 1888, p. 229, pl. 12, fig. 3;—Geol. Survey Missouri, V, 1895, p. 55, pl. 37, fig. 5.

Chonetes geinitzianus Miller, N. American Geol. Pal., 1889, p. 339.

Loc. Nebraska City, Nebraska; Kansas; Iowa; Illinois; Bomjardim and Itaituba, Brazil; Yampopata and Cochabamba, Bolivia.

Chonetes granulifer Owen. Upper Carboniferous.

Chonetes granulifera Owen, Geol. Rep. Iowa, Wisconsin, Minnesota, 1852, p. 583, pl. 5, fig. 12.—Norwood and Pratten, Jour. Acad. Nat. Sci. Philadelphia, III, 1854, p. 24.—Meek, Final Rep. U. S. Geol. Survey Nebraska, 1872, p. 170, pl. 4, fig. 9; pl. 6, fig. 10; pl. 8, fig. 7.—White, Wheeler's Geogr. Geol. Survey west 100 Merid., 1875, p. 122, pl. 9, fig. 8.—Keyes, Geol. Survey Missouri, V, 1895, p. 56.

Chonetes smithii Norwood and Pratten, Jour. Acad. Nat. Sci. Philadelphia, III, 1854, p. 24, pl. 2, fig. 2.—Meek and Worthen, Geol. Survey Illinois, V, 1873, p. 570, pl. 25, fig. 11.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 15B, fig. 12.

Chonetes mucronata Meek and Hayden, Proc. Acad. Nat. Sci. Philadelphia, 1858, p. 262;—Pal. Upper Missouri, Smithsonian Cont. to Knowl., 172, 1864, p. 22, pl. 1, fig. 5.—Geinitz, Carbon u. Dyas in Nebraska, 1866, p. 58, pl. 4, figs. 12–14.—Toula, Sitzungsb. der Kais. Akad. der Wissensch., Wein, LIX, 1869, p. 10.

Chonetes granuliferus Beecher, American Jour. Sci., 3d ser., XLI, 1891, p. 357, pl. 17, fig. 15.

Loc. Mouth of Keg Creek, Iowa; Illinois; Kansas; Missouri; Alabama; Kanab Canyon, Arizona; Cochabamba, Bolivia.

Chonetes hemisphericus Hall. Upper Helderberg (Dev.).

Chonetes hemispherica Hall, Tenth Rep. New York State Cab. Nat. Hist., 1857, p. 116, figs. 1–3.—Billings, Canadian Jour., VI, 1861, p. 349, figs. 121–123; Geol. Canada, 1863, p. 368, fig. 380.—Hall, Pal. New York, IV, 1867, p. 118, pl. 20, fig. 6.—Nicholson, Pal. Prov. Ontario, 1873, p. 75.—Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 123.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 16, fig. 14.

Loc. Schoharie, etc., New York; Eureka district, Nevada; Ontario, Canada.

Chonetes herbert-smithi Rathbun. Middle Devonian.

Chonetes herbert-smithi (Hartt MS.) Rathbun, Bull. Buffalo Soc. Nat. Sci., I, 1874, p. 251, pl. 10, figs. 39–42, 44–47;—Proc. Boston Soc. Nat. Hist., XX, 1879, p. 20.

Loc. Province of Para, Brazil.

Chonetes illinoisensis Worthen. Burlington (L. Carb.).

Chonetes logani Hall (non N. and P.), Geol. Survey Iowa, I, Pt. II, 1858, p. 598, pl. 12, figs. 1, 2.

Chonetes illinoiensis Worthen, Trans. St. Louis Acad. Sci., I, 1860, p. 571.—A. Winchell, Proc. Acad. Nat. Sci. Philadelphia, 1863, p. 5;—Ibidem, 1865, p. 116.—Meek and Worthen, Geol. Survey Illinois, III, 1868, p. 505, pl. 15, fig. 8.—Herrick, Bull. Denison Univ., III, 1888, p. 35, pl. 3, fig. 21.

Loc. Burlington, Iowa; Jersey County, Illinois; Rockford, Indiana; Licking County, Ohio.

Chonetes iowensis Owen=Pholidostrophia iowensis.

Chonetes koninckianus Norwood and Pratten. Middle Devonian.

Chonetes koninckiana Norwood and Pratten, Jour. Acad. Nat. Sci. Philadelphia, III, 1854, p. 30, pl. 2, fig. 11.

Loc. Jonesboro, Union County, Illinois.

Chonetes lævis Keyes=C. glaber Geinitz.

Chonetes laticosta Hall=C. mucronatus.

Chonetes lepidus Hall. Marcellus-Chemung (Dev.).

Chonetes lepida Hall, Tenth Rep. New York State Cab. Nat. Hist., 1857, p. 148;—Pal. New York, IV, 1867, p. 142, pl. 22, figs. 12, 13.—Clarke, Bull. U. S. Geol. Survey, 16, 1885, pp. 24, 32.

Loc. Cayuga Lake, etc., New York; Meadville, Pennsylvania.

Chonetes lineatus (Conrad). Corniferous (Dev.).

Strophomea lineata Conrad, Third Ann. Rep. Geol. Survey New York, 1839, p. 64.—Vanuxem, Geol. New York; Rep. Third Dist., 1842, p. 139, fig. 6 (should be 5a).—Hall, Geol. New York; Rep. Fourth Dist., 1843, p. 175, fig. 8.

Chonetes glabra Hall, Tenth Rep. New York State Cab. Nat. Hist., 1857, p. 117, figs. 1–8.

Chonetes lineata Hall, Pal. New York, IV, 1867, p. 121, pl. 20, fig. 3;—Second Ann. Rep. New York State Geol., 1883, pl. 47, fig. 34.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 16, fig. 34.

Loc. Cayuga Lake, etc., New York.

Chonetes littoni Norwood and Pratten=C. coronatus.

Chonetes logani Hall (non Nor. and Prat.)=C. illinoisensis.

Chonetes logani Norwood and Pratten. Kinderhook-Burlington (L. Carb.).

Chonetes logani Norwood and Pratten, Jour. Acad. Nat. Sci. Philadelphia, III, 1854, p. 30, pl. 2, fig. 12.—A. Winchell, Proc. Acad. Nat. Sci. Philadelphia, 1865, p. 116.—Hall, Pal. New York, IV, 1867, pl. 22, figs. 23, 26–28;—Second Ann. Rep. New York State Geol., 1883, pl. 47, fig. 25.—Herrick, Bull. Denison Univ., III, 1888, p. 35, pl. 3, fig. 12; pl. 7, fig. 22.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 16, fig. 25.

Loc. Burlington, Iowa; Quincy, Illinois; Licking County, Ohio.

Chonetes logani aurora Hall. Tully-Burlington (Dev.-L. Carb.).

Chonetes logani var. aurora Hall, Pal. New York, IV, 1867, p. 137, pl. 22, figs. 16–18;—Second Ann. Rep. New York State Geol., 1883, pl. 47, figs. 9, 18.—Whiteaves, Cont. to Canadian Pal., I, 1891, p. 215, pl. 29, fig. 2.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 16, figs. 9, 18.

Chonetes aurora Williams, Bull. Geol. Soc. America, I, 1890, p. 491, pl. 12, figs. 10, 11.

Loc. Tully and Derruyter, New York; Athabasca, Mackenzie, and Red Deer rivers, Northwest Territory, Canada; Cuyahoga and Licking counties, Ohio; Burlington, Iowa.

Chonetes loganensis Hall and Whitfield. Kinderhook (L. Carb.).

Chonetes loganensis Hall and Whitfield, King's Geol. Expl. 40th Paral., IV, 1877, p. 253, pl. 4, fig. 9.

Loc. Logan Canyon, Wahsatch Range, Utah.

Chonetes maclurea Norwood and Pratten=C. coronatus.

Chonetes macrostriata Walcott=Stropheodonta macrostriata.

Chonetes manitobensis Whiteaves. Upper Devonian.

Chonetes manitobensis Whiteaves, Cont. to Canadian Pal., I, 1892, p. 281, pl. 37, figs. 1, 2.

Loc. Manitoba Island, Lake Manitoba, Canada.

Chonetes martini Norwood and Pratten=C. coronatus.

Chonetes melonicus Billings. Oriskany (Dev.).

Chonetes melonica Billings, Pal. Fossils, II, 1874, p. 15, fig. 6.

Loc. Little Gaspé, Quebec, Canada.

Chonetes mesolobus Norwood and Pratten. Upper Carboniferous.

Chonetes mesoloba Nor. and Prat., Jour. Acad. Nat. Sci. Philadelphia, III, 1854, p. 27, pl. 2, fig. 7.—White, Wheeler's Geogr. Geol. Expl. Survey west 100 Merid., 1875, p. 123, pl. 9, fig. 7.—Hall, Second Ann. Rep. New York State Geol., 1883, pl. 47, fig. 22.—Keyes, Proc. Acad. Nat. Sci. Philadelphia, 1888, p. 228.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 16, fig. 22.

Loc. Belleville, Illinois; Charboniere, Missouri; Flint Ridge, Ohio; New Mexico; Arizona.

Chonetes michiganensis Stevens. Upper Carboniferous.

Chonetes michiganensis Stevens, American Jour. Sci., 2d ser., XXV, 1858, p. 263.

Loc. Battle Creek, Michigan.

Chonetes millipunctata Meek and Worthen=Aulacorhynchus millipunctatum.

Chonetes minima Hall (non Sowerby)=C. undulatus.

Chonetes mucronata Meek and Hayden (non Hall)=C. granulifer.

Chonetes mucronatus Hall. Oriskany-Hamilton (Dev.).

Strophomena mucronata Hall, Geol. New York; Rep. Fourth Dist., 1843, p. 180, fig. 3.

Chonetes laticosta Hall, Tenth Rep. New York State Cab. Nat. Hist., 1857, p. 119.—Billings, Pal. Fossils, II, 1874, p. 20.

Chonetes mucronata Hall, Pal. New York, IV, 1867, p. 124, pl. 20, fig. 1; pl. 21, fig. 1.—Nicholson, Pal. Prov. Ontario, 1873, p. 74.—Hall, Second Ann. Rep. New York State Geol., 1883, pl. 47, figs. 6, 7.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 16, figs. 6, 7.

Chonetes mucronata? Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 124.

Loc. New York; Cayuga, Ontario; Gaspé; Eureka district, Nevada.

Obs. See C. stübeli.

Chonetes multicosta A. Winchell. Kinderhook and Burlington (L. Carb.).
Chonetes multicosta A Winchell, Proc. Acad. Nat. Sci. Philadelphia, 1863, p. 5;—Proc. American Phil. Soc., XII, 1870, p. 250.
Loc. Burlington, Iowa; Hickman and Maury counties, Tennessee.

Chonetes muricata Hall=Strophalosia muricata.

Chonetes nana Norwood and Pratten (non de Verneuil)=C. yandellanus.

Chonetes novascoticus Hall. Arisaig and Niagara (Sil.).
Chonetes novascotica Hall, Canadian Nat. Geol., V, 1860, p. 144, fig. 2.—Dawson, Acadian Geol., 3d ed., 1878, p. 595, fig. 199.—Hall, Twenty-eighth Rep. New York State Mus. Nat. Hist., 1879, p. 155, pl. 22, figs. 11-14;—Eleventh Rep. State Geol. Indiana, 1882, p. 293, pl. 22, figs. 11-14.
Loc. Arisaig, Nova Scotia; Waldron, Indiana.

Chonetes onettianus Rathbun. Middle Devonian.
Chonetes onettiana Rathbun, Bull. Buffalo Soc. Nat. Sci., I, 1874, p. 253, pl. 10, figs. 43, 48.
Loc. Province of Para, Brazil.

Chonetes ornatus Shumard. Chouteau (L. Carb.).
Chonetes ornata Shumard, Geol. Rep. Missouri, 1855, p. 202, Pl. C, fig. 1.—Keyes, Geol. Survey Missouri, V, 1895, p. 53, pl. 38, fig. 2.
Loc. Louisiana and Hannibal, Missouri.
Obs. See C. geniculatus White.

Chonetes parvus Shumard. Upper Carboniferous.
Chonetes parva Shumard, Geol. Rep. Missouri, 1855, p. 201.
Loc. Boone County, Missouri.
Obs. Keyes says this species is a synonym for C. flemingi=C. variolatus.

Chonetes permianus Shumard. Upper Carboniferous.
Chonetes permiana Shumard, Trans. St. Louis Acad. Sci., I, 1859, p. 390.
Loc. Mouth of Delaware Creek, Texas.

Chonetes planumbonus Meek and Worthen. Keokuk (L. Carb.).
Chonetes planumbona Meek and Worthen, Proc. Acad. Nat. Sci. Philadelphia, 1860, p. 450;—Geol. Survey Illinois, II, 1866, p. 253, pl. 18, fig. 1.
Loc. Monroe County, Illinois; Crawfordsville, Indiana; Kings Mountain, Kentucky.

Chonetes platynotus White. Upper Carboniferous.
Chonetes platynota White, Wheeler's Geogr. Geol. Expl. Survey west 100 Merid., Prel. Rep., 1874, p. 19;—Ibidem, Final Rep., IV, 1875, p. 121, pl. 9, fig. 6.
Loc. Santa Fe, New Mexico; near Salt Lake, Utah.

Chonetes pulchellus A. Winchell. Waverly (L. Carb.).
Chonetes pulchella A. Winchell, Proc. Acad. Nat. Sci. Philadelphia, 1862, p. 410;—Ibidem, 1865, p. 115;—Proc. American Phil. Soc., XII, 1870, p. 250.—Herrick, Bull. Denison Univ., III, 1888, p. 37, pl. 3, fig. 14.
Loc. Moscow, Hillsdale County, Michigan; Trumbull, Summit, and Licking counties, Ohio; Shafers, Pennsylvania; Hickman County, Tennessee.

Chonetes punctatus Simpson. Lower Helderberg (Dev.).
Chonetes punctata Simpson, Trans. American Phil. Soc., n. ser., XVI, 1889, p. 438, fig. 3.
Loc. Hazardville, Carbon County, Pennsylvania.

Chonetes pusillus Hall. Hamilton (Dev.).
Chonetes armata Norwood and Pratten (non Bouchard), Jour. Acad. Nat. Sci. Philadelphia, III, 1854, p. 28.

Chonetes pusillus Hall—Continued.

Chonetes pusilla Hall, Tenth Rep. New York State Cab. Nat. Hist., 1857, p. 149;—Pal. New York, IV, 1867, p. 128, pl. 21, fig. 6.—Meek, Trans. Chicago Acad. Sci., I, 1868, p. 93, pl. 13, fig. 2.

Loc. Bakeoven, Illinois; Fort Resolution, Great Slave Lake, British America.

Obs. In the Illinois State collection there is a specimen of C. armatus N. and P. with an old label attached. This specimen is identical with C. pusillus Hall.

Chonetes reversa Whitfield=Chonostrophia reversa.

Chonetes rücki A. Ulrich. Middle Devonian.

Chonetes rücki A. Ulrich, N. Jahrb. f. Mineral., Beilageband, VIII, 1892, p. 79, pl. 5, figs. 1, 2.

Loc. Chahuarani, Icla, and Tarabuco, Bolivia.

Chonetes sarcinulatus Norwood and Pratten.

Chonetes sarcinulata Norwood and Pratten (non Schlotheim), Jour. Acad. Nat. Sci. Philadelphia, III, 1854, p. 28.

Obs. It is impossible to point out the American representative intended by these authors for this species.

Chonetes scitulus Hall. Marcellus–Chemung (Dev.).

Chonetes scitula Hall, Tenth Rep. New York State Cab. Nat. Hist., 1857, p. 147;—Pal. New York, IV, 1867, p. 130, pl. 21, fig. 4;—Second Ann. Rep. New York State Geol., 1883, pl. 47, figs. 3, 4, 27, 32, 40, 44.—Herrick, Bull. Denison Univ., III, 1888, p. 36, pl. 1, fig. 4.—Whitfield, Annals New York Acad. Sci., V, 1891, p. 548, pl. 11, fig. 10.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 16, figs. 3, 4, 27, 32, 40, 44.—Whitfield, Geol. Ohio, VII, 1895, p. 443, pl. 7, fig. 10.—Kindle, Bull. American Pal., 6, 1896, p. 37.

Chonetes scitulus Beecher, American Jour. Sci., XLI, 1891, p. 357, pl. 17, fig. 14.

Loc. Moscow, Hamburg, etc., New York; Meadville, Pennsylvania; Delaware and Licking counties, Ohio.

Chonetes setigerus (Hall). Marcellus-Waverly (Dev.-L. Carb.).

Strophomena setigera Hall, Geol. New York; Rep. Fourth Dist., 1843, p. 180, fig. 2; p. 222, fig. 3.

Chonetes setigera de Koninck, Recher. Animaux Foss., I, 1847, p. 215, pl. 20, fig. 7.—Hall, Tenth Rep. New York State Cab. Nat. Hist., 1857, p. 150;—Pal. New York, IV, 1867, p. 129, pl. 21, fig. 2; p. 142, pl. 22, figs. 1-5;—Second Ann. Rep. New York State Geol., 1883, pl. 47, figs. 2, 5, 19.—Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 125.—Clarke, Bull. U. S. Geol. Survey, 16, 1885, p. 24.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 16, figs. 2, 5, 19.

Chonetes setigera? A. Winchell, Proc. Acad. Nat. Sci. Philadelphia, 1862, p. 411.

Loc. New York; Meadville, Pennsylvania; Ohio; Union City, Branch County, Michigan; Eureka district, Nevada.

Chonetes shumardianus de Koninck. Keokuk (L. Carb.).

Chonetes shumardiana de Koninck, Recher. Animaux Foss., Pt. I, 1847, p. 192, pl. 20, fig. 1.—Norwood and Pratten, Jour. Acad. Nat. Sci. Philadelphia, III, 1854, p. 24.

Loc. The Knobs, Jefferson County, Kentucky.

Chonetes smithii Norwood and Pratten=C. granulifer.

Chonetes striatellus (Dalman). Silurian.

Orthis striatella Dalman, Kgl. Svens. Vetens.-Akad. Handl., 1828, p. 111, pl. 1, fig. 5.

Chonetes striatella Etheridge, Quart. Jour. Geol. Soc. London, XXXIV, 1878, p. 595.

Loc. Europe; Cape Louis Napoleon, lat. 79° 38′.

Chonetes stübeli A. Ulrich. Middle Devonian.

Chonetes stübeli A. Ulrich, N. Jahrb. f. Mineral., Beilageband, VIII, 1892, p. 80, pl. 5, figs. 3, 4.

Loc. Rio Sicasica, Bolivia.

Obs. Probably the same as C. mucronatus.

Chonetes subquadratus Nettelroth. Hamilton (Dev.).

Chonetes subquadrata Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 67.

Loc. Falls of Ohio.

Chonetes tenuistriatus Hall. Arisaig (Sil.).

Chonetes tenuistriata Hall, Canadian Nat. Geol., V, 1860, p. 145, fig. 3.—Dawson, Acadian Geol., 3d ed., 1878, p. 596, fig. 200.

Loc. East River, Nova Scotia.

Chonetes tumidus Herrick. Waverly (L. Carb.).

Chonetes tumidus Herrick, Bull. Denison Univ., III, 1888, p. 36, pl. 2, fig. 21.

Loc. Moots Run, Licking County, Ohio.

Chonetes tuomyi Norwood and Pratten=C. coronatus.

Chonetes undulatus Hall. Niagara (Sil.).

Chonetes minima Hall (non Sowerby), Twenty-eighth Rep. New York State Mus. Nat. Hist., Doc. ed., 1876, pl. 22, fig. 15.

Chonetes undulata Hall, Ibidem, 1879, p. 155, pl. 22, fig. 15;—Eleventh Rep. State Geol. Indiana, 1882, p. 294, pl. 22, fig. 15.

Loc. Waldron, Indiana.

Chonetes variolatus (d'Orbigny). Upper Carboniferous.

Leptæna variolata d'Orbigny, Voyage dans l'Amérique Meridionale; Paléontologie, 1842, p. 49.

Productus variolata d'Orbigny, Ibidem, 1842, pl. 4, figs. 10, 11.

Chonetes variolata de Koninck, Recher. Animaux Foss., Pt. I, 1847, p. 206, pl. 20, fig. 2.—Hall, Stansbury's Expl. Great Salt Lake, 1852, p. 410, pl. 3, fig. 1.—Norwood and Pratten, Jour. Acad. Nat. Sci. Philadelphia, III, 1854, p. 28.

Chonetes flemingi Norwood and Pratten, Ibidem, 1854, p. 26, pl. 2, fig. 5.—Geinitz, Carbon u. Dyas in Nebraska, 1866, p. 59.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 15B, fig. 11.—Keyes, Geol. Survey Missouri, V, 1895, p. 54, pl. 38, fig. 6.

Loc. Yarbichambi, Bolivia; Guernsey, etc., Ohio; Illinois; Missouri; Kansas; Nebraska.

Obs. Compare with C. parvus.

Chonetes verneuilianus Norwood and Pratten. Upper Carboniferous.

Chonetes verneuiliana Norwood and Pratten, Jour. Acad. Nat. Sci. Philadelphia, III, 1854, p. 26, pl. 2, fig. 6.—Newberry, Ives' Rep. Colorado River of the West, 1861, p. 128.—Meek, Final Rep. U. S. Geol. Survey Nebraska, 1872, p. 170, pl. 1, fig. 10.—Hall, Second Rep. New York State Geol., 1883, pl. 47, figs. 20, 21.—White, Thirteenth Rep. State Geol. Indiana, 1884, p. 128, pl. 25, figs. 7, 8.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 16, figs. 20, 21.

Loc. Carboniere, Missouri; Indiana; Illinois; Missouri; Kansas; Nebraska; banks of Colorado River.

Chonetes verneuilianus utahensis Meek. Upper Carboniferous.

Chonetes verneuiliana var. utahensis Meek, Simpson's Rep. Expl. Great Basin, Ter. Utah, 1876, p. 348, pl. 2, fig. 2.

Loc. Near Humboldt Mountains, Utah.

Chonetes vicinus (Castelnau). Hamilton (Dev.).

Leptæna vicina Castelnau, Systeme Sil. l'Amérique Septentrionale, 1843, p. 39, pl. 14, fig. 9.

Chonetes vicina de Koninck, Recher. Animaux Foss., Pt. I, 1847, p. 203.

Chonetes deflecta Hall, Tenth Rep. New York State Cab. Nat. Hist., 1857, p. 149;—Pal. New York, IV, 1867, p. 126, pl. 21, figs. 7, 8;—Second Ann. Rep. N. Y. State Geol., 1883, pl. 47, fig. 28.—Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 24, pl. 2, fig. 8.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 16, fig. 28.

Chonetes gibbosa Hall, Tenth Rep. New York State Cab. Nat. Hist., 1857, p. 145.

Loc. Ontario County, New York; Columbus, Ohio; Wisconsin; Eureka district, Nevada.

Obs. Castelnau's specimens are from "Ontario County, New York." His figures are good and can not be compared with any other species than the well-known C. deflectus Hall, a species occurring abundantly in Ontario County.

Chonetes yandellanus Hall. Corniferous (Dev.).

Chonetes nana de Koninck (non de Verneuil), Recher. Animaux Foss., Pt. I, 1847, p. 213.—Norwood and Pratten (non de Verneuil), Jour. Acad. Nat. Sci. Philadelphia, III, 1854, p. 28.

Chonetes yandellana Hall, Tenth Rep. New York State Cab. Nat. Hist., 1857, p. 118;—Pal. New York, IV, 1867, p. 123, pl. 20, fig. 4.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 68, pl. 17, figs. 16–19; pl. 31, figs. 20, 30.

Loc. Falls of Ohio; Columbus, Ohio.

CHONOPECTUS Hall and Clarke. Genotype Chonetes fischeri N. and P.

Chonopectus Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 312;—Eleventh Ann. Rep. New York State Geologist, 1894, p. 295.

Chonopectus fischeri (Norwood and Pratten). Kinderhook and Burlington (L. Carb.).

Chonetes fischeri Norwood and Pratten, Jour. Acad. Nat. Sci. Philadelphia, III, 1854, p. 25, pl. 2, fig. 3.—Hall, Geol. Survey Iowa, I, Pt. II, 1858, p. 517, pl. 7, fig. 1;—Second Ann. Rep. New York State Geol., 1883, pl. 47, figs. 17, 31.

Chonopectus fischeri Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 312, pl. 15B, figs. 20–23; pl. 16, figs. 17, 31.

Loc. Burlington, Iowa; Warren, Pennsylvania.

CHONOSTROPHIA Hall and Clarke. Genotype Chonetes reversa Whitfield.

Chonostrophia Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 310;—Eleventh Ann. Rep. New York State Geologist, 1894, p. 294.

Chonostrophia complanata Hall. Oriskany (Dev.).

Chonetes complanata Hall, Tenth Rep. New York State Cab. Nat. Hist., 1857, p. 56;—Pal. New York, III, 1859, p. 418, pl. 93, fig. 1;—Second Ann. Rep. New York State Geol., 1883, pl. 47, figs. 13, 29.

Chonostrophia complanata Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 311, pl. 16, figs. 13, 29.

?Strophomena sp. A, A. Ulrich, N. Jahrb. f. Mineral., Beilageband, VIII, 1892, p. 70, pl. 14, fig. 24 (?23).

Loc. Albany and Schoharie counties, New York; Cayuga, Ontario; Cumberland, Maryland; ?Bolivia.

Chonostrophia dawsoni (Billings). Lower Devonian.

Chonetes dawsoni Billings, Pal. Fossils, II, 1874, p. 18, fig. 8.

Chonostrophia dawsoni Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 311.

Loc. Gaspé and Percé, Quebec, Canada.

Chonostrophia helderbergiæ Hall. Lower Helderberg (Dev.).

Chonostrophia helderbergia Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 311, 353, pl. 15B, fig. 14.

Loc. Albany County, New York.

Chonostrophia reversa (Whitfield). Corniferous (Dev.).

Chonetes reversa Whitfield, Annals New York Acad. Sci., II, 1882, p. 213;—Ibidem, V, 1891, p. 549, pl. 11, figs. 8, 9;—Geol. Ohio, VII, 1895, p. 443, pl. 7, figs. 8, 9.

Chonostrophia reversa Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 311, pl. 15B, figs. 15–19;—Thirteenth Ann. Rep. New York State Geologist, 1895, p. 176, pl. 4, fig. 5.

Loc. Columbus and Delaware, Ohio; Union Springs, New York; Cayuga, Ontario.

CHRISTIANIA Hall and Clarke. Genotype Leptæna subquadrata Hall.

Christiania Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 298;—Eleventh Ann. Rep. New York State Geologist, 1894, p. 290.

Christiania subquadrata Hall. Lower Helderberg (Dev.).

Leptæna subquadrata Hall, Second Ann. Rep. New York State Geol., 1883, pl. 46, figs. 32, 33.

Christiania subquadrata Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 298, 351, pl. 15, figs. 32, 33; pl. 15A, fig. 36; pl. 20, figs. 18–20.

Loc. Perry and Blount counties, Tennessee.

CISTELLA Gray. Genotype Terebratula cuneata Risso.

Cistella Gray, Brit. Mus. Cat. Brach., p. 114.

Cistella beecheri Clark. Upper Cretaceous.

Cistella beecheri Clark, Johns Hopkins Univ. Circ., XV, 121, 1896, p. 3.

Loc. Vincentown, New Jersey.

Cistella plicatilis Clark. Upper Cretaceous.

Cistella plicatilis Clark, Johns Hopkins Univ. Circ., XV, 121, 1896, p. 3.

Loc. Vincentown, New Jersey.

CLEIOTHYRIS King.

Genotype Atrypa pectinifera J. de C. Sowerby=Spirifer roissyi L'Éveillé=Athyris roissyi of authors.

Cleiothyris King (non Phillips), Mon. Permian Fossils, Pal. Soc., 1850, p. 137.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 90;—Thirteenth Ann. Rep. New York State Geologist, 1895, p. 779.

Cleiothyris clintonensis (Swallow). Kaskaskia (L. Carb.).

Spirigera clintonensis Swallow, Trans. St. Louis Acad. Sci., II, 1863, p. 89.

Loc. Chester, Illinois; St. Genevieve and Cooper counties, Missouri.

Obs. Compare with C. roissyi. Regarded by Keyes as a synonym for Seminula subquadrata. However, this species does not appear to be a Seminula.

Cleiothyris crassicardinalis (White). Kinderhook (L. Carb.).

Athyris crassicardinalis White, Jour. Boston Soc. Nat. Hist., VII, 1860, p. 229.

Loc. Burlington, Iowa.

Cleiothyris hirsuta Hall. St. Louis and Kaskaskia (L. Carb.).

Spirigera (Athyris) hirsuta Hall, Trans. Albany Institute, IV, 1858, p. 8.

Athyris hirsuta Whitfield, Bull. American Mus. Nat. Hist., I, 1882, p. 49, pl. 6, figs. 18–21.—Hall, *Twelfth Rep. State* Geol. Indiana, 1883, p. 328, pl. 29, figs. *18–21.*

Cleiothyris hirsuta Hall—Continued.

Cliothyris hirsuta Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 46, figs. 25–28.

Loc. Spergen Hill, Indiana; Alton and Chester, Illinois; Princeton, Kentucky; Montana.

Cleiothyris missouriensis (Swallow). Upper Carboniferous.

Spirigera missouriensis Swallow, Trans. St. Louis Acad. Sci., I, 1860, p. 650.

Loc. Montgomery and Chariton counties, Missouri.

Cleiothyris obmaxima (McChesney). Keokuk (L. Carb.).

Athyris obmaxima McChesney, Descriptions New Pal. Foss., 1861, p. 80.

?Spirigera obmaxima White, Wheeler's Expl. Survey west 100 Merid., IV, 1875, p. 92, pl. 5, fig. 12.

Loc. Nauvoo and Warsaw, Illinois; Keokuk, Iowa; Mountain Spring, Nevada; Ophir City, Utah.

Obs. The specimen figured by White may be Athyris incrassata Hall.

Cleiothyris obvia (McChesney). Kaskaskia (L. Carb).

Athyris obvia McChesney, Descriptions New Pal. Foss., 1861, p. 81.

Loc. Kaskaskia, Illinois.

Obs. Probably a synonym for C. roissyi.

Cleiothyris orbicularis (McChesney). Upper Carboniferous.

Athyris orbicularis McChesney, Descriptions New Pal. Foss., 1860, p. 47.

Loc. "Extensively distributed in the Western States."

Obs. Specimens of this species in the United States National Museum donated by Professor Worthen show it to be a Cleiothyris.

Cleiothyris reflexa (Swallow). Warsaw (L. Carb.).

Spirigera reflexa Swallow, Trans. St. Louis Acad. Sci., II, 1863, p. 88.

Loc. Barretts Station, St. Louis County, Missouri.

Obs. Should be compared with C. roissyi. Regarded by Keyes as a synonym for Seminula trinuclea. Swallow's species, however, does not appear to be a Seminula.

Cleiothyris roissyi (L'Éveillé). Keokuk-Kaskaskia (L. Carb.).

Spirifer de roissyi L'Éveillé, Mémoires Soc. Géol. de France, II, 1835, p. 39, pl. 2, figs. 18–20.

Terebratula royssii Marcou, Geol. North America, 1858, p. 51, pl. 6, fig. 10.

Athyris sublamellosa Hall, Geol. Survey Iowa, I, Pt. II, 1858, p. 702, pl. 27, fig. 1.—Derby, Bull. Cornell Univ., I, 1874, p. 10, pl. 2, figs. 9–12; pl. 3, figs. 15–21, 29; pl. 6, fig. 16; pl. 9, figs. 5, 6.

Athyris parvirostris Meek and Worthen, Proc. Acad. Nat. Sci. Philadelphia, 1860, p. 451.

Spirigera americana Swallow, Trans. St. Louis Acad. Sci., II, 1863, p. 89.

Spirigera pectinifera Swallow (non Sowerby), Ibidem, 1863, p. 88.

Athyris planosulcata Geinitz (non Phillips), Carbon u. Dyas in Nebraska, 1866, p. 42.—Meek and Worthen, Geol. Survey Illinois, II, 1866, p. 254, pl. 18, fig. 8.

Spirigera planosulcata? White, Wheeler's Rep. Geogr. Geol. Expl. Survey west 100 Merid., IV, 1875, p. 143, pl. 10, fig. 5.

Athyris planosulcata? Hall and Whitfield, King's U. S. Geol. Expl. 40th Parl., IV, 1877, p. 257, pl. 4, figs. 10, 11.

?Athyris roissyi Meek, Ibidem, 1877, p. 82, pl. 9, fig. 3.

Athyris hirsuta Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 222, pl. 18, fig. 5.

Cliothyris roysii Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 91, pl. 46, figs. 23, 24; pl. 84, fig. 32.

Cleiothyris roissyi (L'Éveillé)—Continued.

Cliothyris sublamellosa Hall and Clarke, Ibidem, 1893, p. 91.

Loc. Europe; Mississippi Valley; White Pine and Eureka districts, Nevada; Salt Lake City, etc., Utah; Lake Valley mining district, etc., New Mexico; Lake County, Colorado; Guatemala; Bomjardin and Itaituba, Brazil.

Obs. American specimens usually referred to this species are constantly smaller and are often without sinus or fold. If these differences are regarded as of sufficient importance to distinguish American specimens from typical C. roissyi then this species will be known as C. sublamellosa Hall. Of Spirigera americana Swallow, authentic specimens have been seen by the writer in Professor Hall's collection. These are identical with Athyris sublamellosa.

Meek's Athyris roissyi (1877) will probably prove to be a new species of Seminula.

See C. clintonensis, C. reflexa Swallow, and C. obvia McChesney.

Cleiothyris squamosa (Worthen). St. Louis (L. Carb.).

Athyris squamosa Worthen, Bull. Illinois State Mus. Nat. Hist., 2, 1884, p. 24;—Geol. Survey Illinois, VIII, 1890, p. 103, pl. 11, fig. 2.

Loc. Monroe County, Illinois.

CLINTONELLA Hall and Clarke.

Genotype C. vagabunda Hall and Clarke.

Clintonella Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 159;—Thirteenth Ann. Rep. New York State Geologist, 1895, p. 814.

Clintonella vagabunda Hall and Clarke. Clinton (Sil.).

Clintonella vagabunda Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 160, pl. 52, figs. 1–11.

Loc. ?Orleans County, New York.

CLITAMBONITES Pander. Genotype Pronites adscendens Pander.

Klitambonites Pander, Beitrage zur Geognosie des Russischen Reiches, 1830, p. 70, pl. 3, fig. 14; pl. 28, figs. 16, 17.

Clitambonites Œhlert, Fischer's Manuel de Conchyliologie, 1887, p. 1289, fig. 1059.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 233.—Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 377.—Hall and Clarke, Eleventh Ann. Rep. New York State Geologist, 1894, p. 274.

Clitambonites adscendens (? Pander). Ordovician.

Orthisina adscendens (Pander) Kayser, Paleontographica, Suppl., III, 1876, p. 20, pl. 2, figs. 9–11.

Loc. Europe; Juan Pobre and Laja, Cordillere San Juan, Argentine Republic.

Obs. This identification is probably erroneous.

Clitambonites(?) borealis (Castelnau).

"Magnesian limestone"=?Galena (Ord.).

Terebratula borealis Castelnau, Essai Syst. Sil. l'Amérique Septentrionale, 1843, p. 40, pl. 14, fig. 14.

Terebratula turpis de Verneuil, Ibidem, 1843, p. 40, footnote.

Loc. "Magnesian limestone of Green Bay, Wisconsin."

Obs. The figure is not satisfactory. The species seems to be related to C. diversus Shaler.

Clitambonites diversus (Shaler). Trenton-Lorraine (Ord.).

Orthisina diversa Shaler, Bull. Mus. Comp. Zool., 4, 1865, p. 67.

Orthisina veneuili Billings (non Eichwald), Catalogue Sil. Foss. Anticosti, 1866, pp. 43, 74.

Hemipronites americanus Whitfield, Ann. Rep. Geol. Survey Wisconsin, 1877, p. 72;—*Geol. Wisconsin, IV, 1882,* p. 243, pl. 10, figs. 15–17.

Clitambonites diversus (Shaler)—Continued.

Streptorhynchus americanus Miller, N. American Geol. Pal., 1889, p. 378.

Clitambonites americanus Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 239, pl. 15A, figs. 1–8.

Clitambonites diversa Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 378, pl. 30, figs. 11–17.—Whiteaves, Pal. Fos., III, Pt. III, 1897, p. 166.

Loc. Anticosti; Cannon Falls, Kenyon, etc., Minnesota; Oshkosh, Wisconsin; Ottawa and Lake Winnipeg, Canada.

Obs. See C. borealis.

Clitambonites diversus altissimus Winchell and Schuchert. Trenton (Ord.).

Clitambonites americanus var. Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 15A, figs. 7, 8.

Clitambonites diversa var. altissima Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 381, pl. 30, figs 18, 19.

Loc. Near Cannon Falls, Minnesota.

Clitambonites (?) johannensis Matthew. Upper Cambrian.

Orthisina johannensis Matthew, Trans. Royal Soc. Canada, IX, 1892, p. 49, pl. 12, figs. 13a–13c.

Loc. Near St. John, New Brunswick.

Clitambonites planus retroflexus (de Verneuil). Lower Ordovician.

Gonambonites plana var. retroflexa de Verneuil, Beitrage zur Geognosie des Russischen Reiches, 1830, p. 77, pl. 25, figs. 1, 2.

Clitambonites (Gonambonites) plana var. retroflexa Matthew, Trans. Roy. Soc. Canada, 2d ser., I, 1896, p. 266, pl. 2, figs. 1a–1c.

Loc. Mc. Feei, Cape Breton, Nova Scotia.

CLORINDA Barrande. Genotype C. armata Barrande.

Clorinda Barrande, Système Silurien Bohème, V, 1879.

Barrandella Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pp. 241, 243;—Thirteenth Ann. Rep. New York State Geologist, 1895, p. 844.

Clorinda arcuosa (McChesney). Niagara (Sil.).

Pentamerus arcuosus McChesney, Descriptions New Pal. Foss., 1861, p. 87.

Loc. Milwaukee, Wisconsin.

Clorinda areyi (Hall and Clarke). Clinton (Sil.).

Barrandella areyi Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pp. 242, 368, pl. 71, figs. 14–16.

Loc. Rochester, New York.

Clorinda barrandei (Billings). Anticosti (Sil.).

Pentamerus barrandi Billings, Geol. Survey Canada; Rep. Progress for 1856, 1857, p. 296;—Geol. Canada, 1863, p. 316, fig. 327.

Barrandella barrandii Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 243, fig. 174; pl. 71, figs. 17–20.

Loc. Anticosti.

Clorinda fornicata (Hall). Clinton and Niagara (Sil.).

Pentamerus fornicatus Hall, Pal. New York, II, 1852, p. 81, pl. 24, fig. 7.

Pentamerus fornicatus var. Hall, Descrip. n. sp. Fossils, Waldron, Indiana, 1879, p. 16;—Eleventh Rep. State Geol. Indiana, 1882, p. 299, pl. 27, fig. 15;—Trans. Albany Institute, X, 1883, p. 72.

Barrandella fornicata Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 243, pl. 70, figs. 11–13.

Loc. Lockport, New York; Waldron, Indiana; Wisconsin.

Clorinda ventricosa (Hall). Niagara (Sil.).

Pentamerus ventricosa Hall, Geol. Survey Wisconsin; Rep. Progress, 1860, p. 2.—Whitfield, Geol. Wisconsin, IV, 1882, p. 291, pl. 17, figs. 11–13.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Survey, 1889, p. 64, pl. 33, figs. 12–14.

Pentamerus chicagoensis Winchell and Marcy, Mem. Boston Soc. Nat. Hist., I, 1865, p. 94, pl. 2, fig. 11.—Hall, Twentieth Rep. New York State Cab. Nat. Hist., 1868, p. 392.

Pentamerus (Pentamerella?) ventricosa Hall, Twentieth Rep. New York State Cab. Nat. Hist., 1868, p. 374, pl. 13, figs. 18–21.

Pentamerus (Pentamerella) ventricosus Hall and Whitfield, Pal. Ohio, II, 1875, p. 138, pl. 7, figs. 7, 8.

Barrandella ventricosa Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 243, pl. 71, figs. 4–10; pl. 84, fig. 46.

Loc. Waukesha, Wisconsin; Bridgeport, Illinois; Louisville, Kentucky; Ohio.

Cœlospira Hall=Anoplotheca.

Cœlospira concava Hall 1867 (not 1863)=Anoplotheca camilla.

Cœlospira disparilis Hall=Atrypina disparilis.

CONCHIDIUM Linné. Genotype C. biloculare Linné.

Conchidium Linné, Museum Tessinianum, 1753, p. 90;—Systema Naturæ, ed. xi, II, 1760, p. 163.—Œhlert, Fischer's Manuel de Conchyliologie, 1887, p. 1311.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 231;—Thirteenth Ann. Rep. New York State Geologist, 1895, p. 842.

Helmintholitus Linné, Systema Naturæ, ed. xii, IV, 1766, p. 163.

Pentamerus Sowerby (non Pentamera Dumeril, 1806), Mineral Conchology, I, 1813, p. 73.

Gypidia Dalman, Kongl. Svenska Vet.-Akad. Handl., för 1827, 1828, pp. 93, 100.

Pentamerus Billings, Canadian Jour., VI, 1861, p. 269.—Hall, Twentieth Rep. New York State Cab. Nat. Hist., 1867, p. 163;—Pal. New York, IV, 1867, pp. 369, 373.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 52.

Antirhynchonella Quenstedt, Petref. Deutschlands, Brach., 1871, p. 231.

Zdimir Barrande, Système Silurien Bohème, VI, 1881, p. 171.

Conchidium biloculare Linné. Silurian.

Conchidium biloculare Linné, Systema Naturæ, ed. xi, II, 1760, p. 163.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 233, pl. 6, figs. 11–14.

Pentamerus conchidium Emmerson, Geol. Frobischer Bay; Nourses Narr. Hall's Arctic Exped., 1879, p. 578.

Loc. Europe; Rescue Harbor, Arctic America.

Conchidium colletti (Miller). Waterlime (Sil.).

Petamerus colletti Miller, Seventeenth Rep. State Geol. Indiana, 1891, p. 77, pl. 18, figs. 5, 6.

Conchidium colletti Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 235, pl. 66, figs. 16, 17.

Loc. Kokomo, Indiana.

Obs. Compare with C. laqueatum Conrad.

Conchidium crassiplica Hall and Clarke. Niagara (Sil.).

Conchidium crassiplica Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pp. 235, 369, pl. 66, figs. 24, 25.

Loc. ?Near Louisville, Kentucky.

Conchidium crassiradiatum (McChesney). Niagara (Sil.).

Pentamerus crassoradius McChesney, Descriptions New Pal. Foss., 1861, p. 87.

Loc. Milwaukee, Wisconsin.

Conchidium decussatum (Whiteaves). Silurian.

Pentamerus decussatus Whiteaves, Canadian Record of Science, 1891, p. 295, pl. 3, figs. 3, 4.—Calvin, Bull. Lab. Nat. Hist. State Univ. Iowa, XI, 1892, p. 164, pl. 11, figs. 1–3; pl. 12, fig. 2.

Conchidium decussatum Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 235, pl. 65, figs. 1, 2; pl. 66, fig. 15.

Loc. Grand Rapids of the Saskatchewan, etc., Canada.

Conchidium exponeum Hall and Clarke. Niagara (Sil.).

Conchidium exponeus Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 66, figs. 6–9.

Loc. Louisville, Kentucky.

Conchidium georgiæ Hall and Clarke. Clinton (Sil.).

Conchidium georgiæ Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, p. 369, pl. 66, figs. 18, 19.

Loc. Trenton, Georgia.

Conchidium greenei Hall and Clarke. Niagara (Sil.).

Conchidium greenii Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pp. 235, 368, pl. 66, figs. 20–22.

Loc. Near Milwaukee, Wisconsin.

Conchidium knappi (Hall and Whitfield). Niagara (Sil.).

Pentamerus knappi Hall and Whitfield, Twenty-fourth Rep. New York State Cab. Nat. Hist., 1872, p. 184.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 55, pl. 28, figs. 1–4.

Pentamerus? knappi Hall and Whitfield, Twenty-seventh Rep. New York State Cab. Nat. Hist., 1875, pl. 10, figs. 10–12.

Conchidium knappi Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 235, pl. 64, figs. 11–13.

Loc. Louisville, Kentucky

Conchidium knighti (Nettelroth). ?Corniferous (Dev.).

Pentamerus knighti Nettelroth (non Sowerby), Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 57, pl. 29, figs. 1, 2, 17.

Conchidium nettelrothi Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 234, pl. 64, figs. 14–16.

Loc. Louisville, Kentucky.

Obs. This species is very much like C. nysius and may be identical with it (Ami says that C. knighti occurs in the Upper Silurian at Arisaig, Nova Scotia).

Conchidium laqueatum (Conrad). Niagara (Sil.).

Pentamerus laqueatus Conrad, Proc. Acad. Nat. Sci. Philadelphia, VII, 1855, p. 441.

Pentamerus nobilis Emmons, Manual of Geol., 1860, p. 107, figure.

Conchidium laqueatus Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 232, fig. 168; p. 234, pl. 65, figs. 3–9.

Loc. Delphi, Indiana.

Conchidium littoni Hall. Niagara (Sil.).

Pentamerus littoni Hall, Pal. New York, III, 1859, p. 262.—Hall and Whitfield, Twenty-fourth Rep. New York State Cab. Nat. Hist., 1872, p. 186;—Twenty-seventh Rep. Ibidem, 1875, pl. 10, figs. 8, 9.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 58, pl. 27, figs. 12, 13.

Conchidium littoni Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 64, figs. 9, 10.

Loc. Hardin County, Tennessee; Louisville, Kentucky.

Conchidium multicostatum Hall. Niagara (Sil.).

Pentamerus multicostatus Hall, Geol. Survey Wisconsin; Rep. Progress, 1860, p. 1;—Twentieth Rep. New York State Cab. Nat. Hist., 1867, p. 373, pl. 13, figs. 22–24.

Conchidium multicostatum Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 64, fig. 6; pl. 66, fig. 10.

Loc. Wauwatosa and Waukesha, Wisconsin.

Conchidium nettelrothi Hall and Clarke=C. knighti.

Conchidium nysius (Hall and Whitfield). Niagara (Sil.).

Pentamerus nysius var. crassicosta Hall and Whitfield, Twenty-fourth Rep. New York State Cab. Nat. Hist., 1872, p. 184;—Twenty-seventh Rep. Ibidem, 1875, pl. 10, figs, 4–7.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 60, pl. 28, figs. 5–8.

Pentamerus nysius var. tenuicostatus Nettelroth, Ibidem, 1889, p. 60.

Conchidium nysius Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 235, pl. 64, figs. 1, 8, 27.

Loc. Louisville, Kentucky.

Obs. See C. tenuicostatum.

Conchidium obsoletum Hall and Clarke. Niagara (Sil.).

Conchidium obsoletum Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 67, figs. 8, 9.

Loc. Genoa, Ottawa County, Ohio.

Conchidium occidentale Hall. Guelph (Sil.).

Pentamerus occidentalis Hall, Pal. New York, II, 1852, p. 341, pl. 79, figs. 1, 2.—Billings, Geol. Canada, 1863, p. 337, fig. 341.—Nicholson, Pal. Prov. Ontario, 1875, p. 67, fig. 35.—Whitfield, Geol. Wisconsin, IV, 1882, p. 314, pl. 17, fig. 10; pl. 23, figs. 1, 2.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 239.

Conchidium(?) occidentalis Hall and Clarke, Ibidem, 1895, pl. 67, figs. 1–5.

Loc. Gault and Guelph, Ontario; Point St. Vital, Lake Huron; Williamstown, Wisconsin.

Conchidium(?) salinense (Swallow). "Base of Chemung" (Dev.).

Pentamerus salinensis Swallow, Trans. St. Louis Acad. Sci., I, 1860, p. 652.—Keyes, Geol. Survey Missouri, V, 1895, p. 104.

Loc. Moniteau County, Missouri.

Obs. The geological horizon is probably Corniferous or Hamilton.

Conchidium scoparium Hall and Clarke. Guelph (Sil.).

Conchidium scoparium Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 67, figs. 6, 7.

Loc. Durham, Ontario.

Conchidium tenuicostatum (Hall and Whitfield). Niagara (Sil.).

Pentamerus nysius var. tenuicosta Hall and Whitfield, Twenty-fourth Rep. New York State Cab. Nat. Hist., 1872, p. 184;—Twenty-seventh Rep. Ibidem, 1875, pl. 10, figs. 1–3.

Pentamerus complanatus Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 53, pl. 27, figs. 14–16.

Conchidium tenuicostatus Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 235, pl. 64, figs. 3–5.

Loc. Louisville, Kentucky.

Obs. P. nysius is described as consisting of two varieties. If these varieties are species, as pointed out by Nettelroth, then P. nysius will be based upon and supplant variety crassicosta, while variety tenuicosta must be elevated to specific rank. P. complanatus Nettelroth, therefore, becomes a synonym for C. tenuicostatum, *as both are* established upon the same specimens.

Conchidium unguiforme (Ulrich). Niagara (Sil.).

Gypidia unguiformis Ulrich, Contrib. American Pal., 1886, p. 28, pl. 3, fig. 2.

Gypidula unguiformis Miller, N. American Geol. Pal., 1889, p. 346.

Conchidium unguiformis Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 235, pl. 66, figs. 1–4.

Loc. Louisville, Kentucky.

CONOTRETA Walcott. Genotype C. rusti Walcott.

Conotreta Walcott, Proc. U. S. Nat. Mus., XII, 1890, p. 365 (extract 1889).—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 104, 167;—Eleventh Ann. Rep. New York State Geologist, 1894, p. 250.

Conotreta rusti Walcott Trenton (Ord.).

Conotreta rusti Walcott, Proc. U. S. Nat. Mus., XII, 1890, p. 365, figs. 1–4 (extract 1889).—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 104, pl. 4K, figs. 16–21.

Loc. Trenton Falls, New York; Covington, Kentucky.

Conradia Hall and Clarke (non Adams)=Dinobolus.

CRANÆNA Hall and Clarke. Genotype Terebratula romingeri Hall.

Cranæna Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 297;—Thirteenth Ann. Rep. New York State Geologist, 1895, p. 865.

Cranæna iowensis (Calvin). Middle Devonian.

Terebratula (Cryptonella) iowensis Calvin, Bull. Lab. Nat. Hist. Univ. Iowa, I, 1890, p. 174, pl 3, fig. 4.

Cranæna iowensis Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 297, pl. 80, figs. 36–39; pl. 83, fig. 40.

Loc. Fayette, Iowa; Fulton, Missouri.

Cranæna romingeri Hall. Hamilton (Dev.).

Terebratula romingeri Hall, Sixteenth Rep. New York State Cab. Nat. Hist., 1863, p. 48, figs. 22, 23;—Pal. New York, IV, 1867, p. 389, pl. 60, figs. 17–25, 66, 67.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 155, pl. 16, figs. 20–22.

Cranæna romingeri Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 297, fig. 215; pl. 80, figs. 13–19.

Loc. Thunder Bay, Michigan; Waterloo, Iowa; York and Hamburg, New York; Clarke County, Indiana.

CRANIA Retzius. Genotype Anomia craniolaris Linné.

Crania Retzius, Schrift. Ges. Naturf. Freunde, Berlin, II, 1781, p. 72.—Dall, Bull. Mus. Comp. Zool., III, 1871, p. 27;—Bull. U. S. Nat. Mus., 8, 1877, p. 21.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 31.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 145, 169.—Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 372.—Hall and Clarke, Eleventh Ann. Rep. New York State Geologist, 1894, p. 260.

Crania acadiensis Hall. Arisaig (Sil.).

Crania acadiensis Hall, Canadian Nat. Geol., V, 1860, p. 144, fig 1.—Dawson, Acadian Geol., 3d ed., 1878, p. 595, fig. 198.

Loc. East River, Nova Scotia.

Crania agaricina Hall and Clarke. Lower Helderberg (Dev.).

Crania agaricina Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 180, pl. 4H, fig. 2.

Loc. Albany County, New York; Decatur County, Tennessee.

Crania albersi Miller and Faber. Utica (Ord.).

Crania albersi Miller and Faber, Jour. Cincinnati Soc. Nat. Hist., XVII, 1894, p. 154, pl. 8, figs. 17–19.

Loc. Cincinnati, Ohio.

Crania alternata James=C. scabiosa.

Crania anna Spencer. Niagara (Sil.).

Crania anna Spencer, Bull. Univ. Missouri, I, 1884, p. 57;—Trans. St. Louis Acad. Sci., IV, 1886, p. 607, pl. 8, fig. 4.

Loc. Hamilton, Ontario.

Crania asperula James=C. scabiosa.

Crania aurora Hall. Schoharie Grit (Dev.).

Crania aurora Hall, Sixteenth Rep. New York State Cab. Nat. Hist., 1863, p. 30;—Pal. New York, IV, 1867, p. 27, pl. 5, fig. 12.

Loc. Knox, Albany County, New York.

Crania bella Billings. No. 5 Gaspé Series (?Dev.).

Crania bella Billings, Pal. Fossils, II, 1874, p. 15, fig. 5.

Loc. Cape Bon Ami, Gaspé, Canada.

Crania blairi Miller=C. rowleyi.

Crania bordeni Hall and Whitfield=C. sheldoni.

Crania carbonaria Whitfield=C. modesta.

Crania centralis Hall. Portage (Dev.).

Crania centralis Hall, Pal. New York, V, Pt. II, 1879, pl. 88, fig. 2.

Loc. Watkins, New York.

Crania chesterensis Miller and Gurley. Kaskaskia (L. Carb.).

Crania chesterensis Miller and Gurley, Bull. Illinois State Mus. Nat. Hist., 12, 1897, p. 47, pl. 3, figs. 24–26.

Loc. Chester, Illinois.

Crania(?) columbiana Walcott. Middle Cambrian.

Crania? columbiana Walcott, Proc. U. S. Nat. Mus., XI, 1888, p. 441.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 150.

Loc. Mount Stephan, British Columbia.

Obs. Probably a species of Acrotreta.

Crania costata James=C. scabiosa.

Crania crenistriata Hall. Corniferous and Hamilton (Dev.).

Crania crenistria Hall, Thirteenth Rep. New York State Cab. Nat. Hist., 1860, p. 78, fig. 6, on p. 76;—Pal. New York, IV, 1867, p. 28, pl. 3, figs. 13–16.—Hall and Clarke, Ibidem, VIII, Pt. I, 1892, pl. 4H, figs. 6–12.

Loc. Alexander, etc., New York; Columbus, Ohio; Louisville, Kentucky; Alpena, Michigan.

Obs. See C. sheldoni White.

Crania(?) deformata (Hall). Chazy (Ord.).

Orbicula? deformata Hall, Pal. New York, I, 1847, p. 23, pl. 4 bis, fig. 10.

Crania? deformata Miller, N. American Geol. Pal., 1889, p. 341.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 150.

Loc. Chazy, New York.

Obs. This species is not well established and had better be dropped since the type specimen does not preserve the generic or specific characters.

Crania dentata Ringueberg. Niagara (Sil.).

Crania dentata Ringueberg, Bull. Buffalo Soc. Nat. Sci., V, 1886, p. 16, pl. 2, fig. 6.

Loc. Lockport, New York.

?Crania dubia Foerste. Clinton (Sil.).

? Crania dubia Foerste, Geol. Ohio, VII, 1895, p. 565, pl. 37, fig. 17.

Loc. Dayton, Ohio.

Obs. May not be a brachiopod.

Crania dyeri Miller. Utica (Ord.).

Crania dyeri Miller, Cincinnati Quart. Jour. Sci., II, 1875, p. 13, fig. 3.

Loc. Cincinnati, Ohio.

Crania famelica Hall and Whitfield. Hamilton (Dev.).

Crania famelica Hall and Whitfield, Descriptions n. sp. Fossils, 1872, p. 17, pl. 11, figs. 6, 7;—Twenty-third Rep. New York State Cab. Nat. Hist., 1873, p. 236, pl. 11, figs. 6, 7.

Loc. Cerro Gordo, Iowa; Callaway County, Missouri.

Obs. Compare with Craniella hamiltoniæ Hall.

Crania favincola Hall and Clarke. Middle Devonian.

Crania favincola Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 180, pl. 4H, fig. 33.

Loc. Crab Orchard, Kentucky.

Crania gracilis Ringueberg. Niagara (Sil.).

Crania gracilis Ringueberg, Bull. Buffalo Soc. Nat. Sci. V, 1886, p. 17, pl. 2, fig. 7.

Crania pannosa Ringueberg, Ibidem, 1886, p. 17, pl. 2, fig. 8.

Loc. Lockport, New York.

Obs. Species of Crania are very variable in shape, and since both forms are attached to one Orthoceras, it is probable that but a single species is here represented.

Crania granosa Hall and Clarke. Hamilton (Dev.).

Crania granosa Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 180, pl. 4H, figs. 19, 20.

Loc. Centerfield, New York.

Crania granulosa N. H. Winchell. Trenton (Ord.).

Crania granulosa N. H. Winchell, Eighth Ann. Rep. Geol. Nat. Hist. Survey Minnesota, 1880, p. 63.—Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 373, pl. 29, figs. 34, 35.

Loc. Minneapolis, Minnesota.

Crania gregaria Hall=Craniella hamiltoniæ.

Crania greenei Miller. Upper Helderberg (Dev.).

Crania greenii Miller, Eighteenth Ann. Rep. Geol. Survey Indiana, 1894, p. 310, pl. 9, fig. 7.

Loc. Falls of Ohio.

Obs. Probably the same as Craniella hamiltoniæ.

Crania halli Sardeson=Craniella ulrichi.

Crania hamiltoniæ Hall=Craniella hamiltoniæ.

Crania lælia Hall. Utica and Lorraine (Ord.).

Crania lælia Hall, Descriptions n. sp. Crinoidea and other Fossils, 1866, p. 13;—Twenty-fourth Rep. New York State Cab. Nat. Hist., 1872, p. 220, pl. 7, fig. 16.—Miller, Cincinnati Quart. Jour. Sci., II, 1875, p. 12.—Hall and Whitfield, Pal. Ohio, II, 1875, p. 75, pl. 1, fig. 16.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 4H, fig. 1.

Loc. Cincinnati and Oxford, Ohio; Richmond, Indiana.

Crania lævis Keyes. Chouteau (L. Carb.).

Crania lævis Keyes, Geol. Survey Missouri, V, 1895, p. 40.

Loc. Louisiana, Missouri.

Crania leoni Hall. Portage and Chemung (Dev.).

Crania leoni Hall, Thirteenth Rep. New York State Cab. Nat. Hist., 1860, p. 78, figs. 7, 8 on p. 76;—Pal. New York, IV, 1867, p. 30, pl. 3, figs. 27-30, (?25, 26).—Hall and Clarke, Ibidem, VIII, Pt. I, 1892, pl. 4H, figs. 34, 35.

Loc. Leon, New York. Portage of Ontario County, New York (Clarke).

Crania modesta White and St. John. Upper Carboniferous.

Crania modesta White and St. John, Trans. Chicago Acad. Sci., I, 1868, p. 118.—White, Thirteenth Rep. State Geol. Indiana, 1884, p. 121, pl. 35, fig. 9; pl. 36, fig. 5.

Crania carbonaria Whitfield, Annals New York Acad. Sci., II, 1882, p. 229;—Ibidem, V, 1891, p. 599, pl. 15, figs. 11, 12;—Geol. Ohio, VII, 1895, p. 484, pl. 11, figs. 11, 12.

Loc. Fremont County, Iowa; Vermilion and Sullivan counties, Indiana; Carbon Hill, Ohio; Manhattan, Kansas.

Crania multipunctata Miller=C. scabiosa.

Crania pannosa Ringueberg=C. gracilis.

Crania parallela Ulrich=C. scabiosa.

Crania percarinata Ulrich=C. scabiosa.

Crania(?) permiana Shumard. Upper Carboniferous.

Crania permiana Shumard, Trans. St. Louis Acad. Sci., I, 1859, p. 395.

Loc. Guadalupe Mountains, New Mexico.

Obs. Probably not a Crania.

Crania pulchella Hall and Clarke. Lower Helderberg (Dev.).

Crania pulchella Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 180, pl. 4H, fig. 3.

Loc. Albany County, New York.

Crania radicans A. Winchell=Strophalosia radicans.

Crania reposita White. Burlington (L. Carb.).

Crania reposita White, Proc. Boston Soc. Nat. Hist., IX, 1862, p. 30.

Loc. Burlington, Iowa.

Crania reticularis Miller=Trematis reticularis.

Crania(?) reversa Sardeson. St. Peter (Ord.).

Crania(?) reversa Sardeson, Bull. Minnesota Acad. Nat. Sci., IV, 1896, p. 77, pl. 3, figs. 6, 7.

Loc. St. Paul, Minnesota.

Crania rowleyi Gurley. Chouteau (L. Carb.).

Crania rowleyi Gurley, New Carb. Fossils, 1, 1883, p. 3.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 4H, fig. 13.

Crania blairi Miller, Eighteenth Ann. Rep. Geol. Survey Indiana, 1894, p. 310, pl. 9, figs. 5, 6.

Loc. Pike County and Sedalia, Missouri.

Crania scabiosa Hall. Utica and Lorraine (Ord.).

Crania scabiosa Hall, Descriptions n. sp. Crinoidea and other Foss., 1866, p. 13;—Twenty-fourth Rep. New York State Cab. Nat. Hist., 1872, p. 220, pl. 7, fig. 15.—Hall and Whitfield, Pal. Ohio, II, 1875, p. 74, pl. 1, fig. 17.—Miller, Cincinnati Quart. Jour. Sci., II, 1875, p. 12.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 148, pl. 4H, figs. 23–28, 30, 31.

Crania multipunctata Miller, Cincinnati Quart. Jour. Sci., II, 1875, p. 13, fig. 4.

Crania percarinata Ulrich, Jour. Cincinnati Soc. Nat. Hist., I, 1878, p. 98, pl. 4, fig. 12.

Crania parallela Ulrich, Ibidem, 1878, p. 98, pl. 4, fig. 13.

Crania asperula James, The Palæontologist, 3, 1879, p. 22.

Crania costata James, Ibidem, 1879, p. 22.

Crania alternata James, Ibidem, 1879, p. 23.

Loc. Cincinnati, etc., Ohio; Indiana; Illinois; Wisconsin.

Obs. The shells of Crania are adapted to the objects upon which they are cemented.

Crania scabiosa Hall—Continued.

C. scabiosa has been found growing on Rafinesquina, Strophomena, Rhynchonella, Pleurotomaria, and Monticulipora. In nearly all cases this species partakes more or less of the ornamentation of its host. The variation pointed out by authors is accidental and has no specific value.

Crania setifera Hall. Niagara (Sil.).

Crania setifera Hall, Trans. Albany Institute, IV, 1863, p. 209 (non Hall, 1866);—Twenty-eighth Rep. New York State Mus. Nat. Hist., Doc. ed., 1876, pl. 21, figs. 8–10;—Ibidem, 1879, p. 148, pl. 21, figs. 8–10;—Eleventh Rep. State Geol. Indiana, 1882, p. 283, pl. 21, figs. 8–10.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 4H, fig. 18.

Loc. Waldron, Indiana.

Crania setigera Hall. Trenton and Lorraine (Ord.).

Crania setigera Hall, Descriptions n. sp. Crinoidea and other Fossils, 1866, p. 12;—Twenty-fourth Rep. New York State Cab. Nat. Hist., 1872, p. 220, pl. 7, fig. 15.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 4H, figs. 14–16.—Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 372, pl. 29, figs. 32, 33.

Loc. Mineral Point and Beloit, Wisconsin; Decorah, Iowa; Minneapolis, Cannon Falls, etc., Minnesota; Wilmington, Illinois.

Crania sheldoni White. Hamilton (Dev.).

Crania sheldoni White, Proc. Boston Soc. Nat. Hist., IX, 1862, p. 29.

Crania bordeni Hall and Whitfield, Twenty-fourth Rep. New York State Cab. Nat. Hist., 1872, p. 187;—Twenty-seventh Rep. Ibidem, 1875, pl. 9, figs. 36, 37.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 32, pl. 2, fig. 14.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 4H, figs. 4, 5.

Loc. New Buffalo and Iowa City, Iowa; Falls of Ohio.

Obs. This species may not be distinct from C. crenistria.

Crania siluriana Hall. Niagara (Sil.).

Crania siluriana Hall, Trans. Albany Institute, IV, 1863, p. 208;—Twenty-eighth Rep. New York State Mus. Nat. Hist., 1879, p. 148, pl. 21, figs. 3–7;—Eleventh Rep. State Geol. Indiana, 1882, p. 282, pl. 21, figs. 3–7.—Beecher and Clarke, Mem. New York State Mus., I, 1889, p. 13, pl. 1, figs. 1, 2.

Loc. Waldron, Indiana.

Crania socialis Ulrich. Utica (Ord.).

Crania socialis Ulrich, Jour. Cincinnati Soc. Nat. Hist., I, 1878, p. 98, pl. 4, fig. 14.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 4H, fig. 29.

Loc. Cincinnati, Ohio.

Crania spinigera Hall. Niagara (Sil.).

Crania spinigera Hall, Descriptions n. sp. Foss. Waldron, Indiana, 1879, p. 13;—Eleventh Rep. State Geol. Indiana, 1882, p. 283, pl. 27, fig. 1;—Trans. Albany Institute, X, 1883, p. 69.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 4H, fig. 17.

Loc. Waldron, Indiana.

Crania trentonensis Hall. Trenton (Ord.).

Crania trentonensis Hall, Descriptions n. sp. Crinoidea and other Fossils, 1866, p. 12;—Twenty-fourth Rep. New York State Cab. Nat. Hist., 1872, p. 219, pl. 7, figs. 11, 12.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 4H, figs. 21, 22.—Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 374, pl. 29, figs. 36, 37.

Loc. Middleville, New York; Cannon Falls, Minnesota; Janesville, Wisconsin; Dixon, Illinois.

CRANIELLA Œhlert. Genotype C. meduanensis Œhlert.

Craniella Œhlert, Bull. Soc. Études Scientif. d'Angers, 1888, p. 37.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 153, 170.—Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 374.—Hall and Clarke, Eleventh Ann. Rep. New York State Geologist, 1894, p. 262.

Craniella(?) clintonensis Foerste. Clinton (Sil.).

Craniella? clintonensis Foerste, Geol. Ohio, VII, 1895, p. 565, pl. 37, figs. 3a, 3b.

Loc. Todds Fork, Ohio.

Craniella hamiltoniæ Hall. Hamilton (Dev.).

Crania hamiltoniæ Hall, Thirteenth Rep. New York State Cab. Nat. Hist., 1860, p. 77, figs. 4, 5, on p. 76;—Pal. New York, IV, 1867, p. 27, pl. 3, figs. 17–23.—Whiteaves, Cont. Canadian Pal., I, 1891, p. 214.

?Crania hamiltoniæ? Herrick, Bull. Denison Univ., III, 1888, p. 31, pl. 12, fig. 10.

Crania gregaria Hall, Sixteenth Rep. New York State Cab. Nat. Hist., 1863, p. 31;—Pal. New York, IV, 1867, p. 29, pl. 3, fig. 24.

Craniella hamiltoniæ Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 148, 153, pl. 41, figs. 3–16.

Loc. Cazenovia, Hamilton, etc., New York; Hay and Athabasca rivers, Canada. (Waverly group, Moote Run, Licking County, Ohio, according to Herrick.)

Obs. See Crania greenei Miller.

Craniella(?) ulrichi Hall and Clarke. Trenton (Ord.).

Craniella ulrichi Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 153, 181, pl. 4, figs. 1, 2.

Crania halli Sardeson, Bull. Minnesota Acad. Nat. Sci., III, 1892, p. 328, pl. 4, figs. 8–10.

Craniella? ulrichi Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 375, pl. 29, figs. 38, 39.

Loc. Minneapolis, St. Paul, and Fountain, Minnesota.

Craniops Hall=Pholidops.

CRYPTACANTHIA White and St. John.
Genotype Waldheimia? compacta White and St. John.

Cryptacanthia White and St. John, Trans. Chicago Acad. Sci., I, 1868, p. 119.—Dall, American Jour. Conch., VI, 1870, p. 114.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 300;—Thirteenth Ann. Rep. New York State Geologist, 1895, p. 867.

Cryptacanthia compacta White and St. John. Upper Carboniferous.

Waldheimia? (Cryptacanthia) compacta White and St. John, Trans. Chicago Acad. Sci., I, 1868, p. 119, fig. 3.

Cryptacanthia compacta Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 301, fig. 225.

Loc. Madison County, Missouri.

CRYPTONELLA Hall, 1867. Genotype Terebratula rectirostra Hall.

?Cryptonella Hall, Fourteenth Rep. New York State Cab. Nat. Hist., 1861, pp. 101, 102;—Fifteenth Rep. Ibidem, 1862, p. 160, pl. 3, figs. 8, 9.—Billings, Canadian Nat. Geol., VII, 1862, p. 392.—Hall, Sixteenth Rep. New York State Cab. Nat. Hist., 1863, p. 43, figs. 1–7 on p. 42;—American Jour. Sci., 2d ser., XXXV, 1863, p. 396.—Billings, Ibidem, XXXVI, 1863, p. 238.—Hall, Trans. Albany Institute, IV, 1863, pp. 132, 148.

Centronella (partim) A. Winchell, Proc. Acad. Nat. Sci. Philadelphia, 1865, p. 123.

Cryptonella Hall, Twentieth Rep. New York State Cab. Nat. Hist., 1867, p. 164;—Pal. New York, IV, 1867, p. 392.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 286;—Thirteenth Ann. Rep. New York State Geologist, 1895, p. 860.

Obs. This genus can not be considered as established before 1867.

Cryptonella calvini Hall and Whitfield=Dielasma calvini.

Cryptonella(?) circulus Walcott. Devonian.

Cryptonella? circula Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 163, pl. 15, fig. 2.

Loc. Lone Mountain, Nevada.

Obs. Additional material shows that this species attained a length of 1 inch.

Cryptonella eudora Hall and Whitfield, 1873=Dielasma calvini.

Cryptonella(?) eudora Hall. Chemung-Waverly (Dev.-L. Carb.).

Cryptonella (Terebratula) eudora Hall, Pal. New York, IV, 1867, p. 398, pl. 61, figs. 31–41.

Cryptonella eudora Herrick, Bull. Denison Univ., III, 1888, p. 48, pl. 5, fig. 10;—Geol. Ohio, VII, 1895, pl. 21, fig. 10.

Loc. Ithaca, New York; Licking County, Ohio.

Cryptonella(?) eximia Hall. Lower Helderberg (Dev.).

Cryptonella eximia Hall, Fifteenth Rep. New York State Cab. Nat. Hist., 1862, p. 160, pl. 3, figs. 6, 7;—Sixteenth Rep. Ibidem, 1863, p. 43, figs. 10, 11.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 80, figs. 11, 12.

Loc. Not given.

Cryptonella(?) inconstans (Herrick). Waverly (L. Carb.).

Terebratula? inconstans Herrick, Bull. Denison Univ., IV, 1888, p. 24, pl. 3, figs. 8, 9; pl. 11, fig. 18.

Cryptonella(?) inconstans Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 79, figs. 31, 32.

Terebratula inconstans Herrick, Geol. Ohio, VII, 1895, pl. 23, fig. 17.

Loc. Ashland County and Lodi, Ohio.

Cryptonella iowensis Calvin=Crania iowaensis.

Cryptonella iphis Hall. Corniferous (Dev.).

Cryptonella iphis Hall, Pal. New York, IV, 1867, p. 396, pl. 61, figs. 26–28.

Loc. Cayuga, Ontario.

Cryptonella lens Hall. Corniferous (Dev.).

Terebratula lens Hall, Thirteenth Rep. New York State Cab. Nat. Hist., 1860, p. 89;—Pal. New York, IV, 1867, p. 386, pl. 60, figs. 1–4.

Cryptonella lens Hall and Whitfield, Twenty-fourth Rep. New York State Cab. Nat. Hist., 1872, p. 199.

Loc. Clarence Hollow, New York; Falls of Ohio.

Cryptonella lincklæni Hall=Eunella lincklæni.

Cryptonella ovalis Miller. Hamilton (Dev.).

Cryptonella ovalis Miller, Seventeenth Rep. State Geol. Indiana, 1891, p. 76, pl. 13, figs. 1, 2.

Loc. Bunker Hill, Indiana.

Cryptonella pinonensis Walcott. Upper Devonian.

Cryptonella pinonensis Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 163, pl. 4, fig. 4.

Loc. Pinon Range, Nevada.

Cryptonella planirostris Hall. Marcellus, Hamilton (Dev.).

Terebratula planirostra Hall, Thirteenth Rep. New York State Cab. Nat. Hist., 1860, p. 89.

Cryptonella planirostra Hall, Fourteenth Rep. New York State Cab. Nat. Hist., 1861, p. 101;—Sixteenth Rep. Ibidem, 1863, p. 44;—Pal. New York, IV, 1867, p. 395, pl. 61, figs. 9–27.—Hall and Clarke, Ibidem, VIII, Pt. II, 1893, p. 287, fig. 208; pl. 80, figs. 5–10.

Loc. Seneca and Canandaigua lakes, New York.

Cryptonella rectirostris Hall. Hamilton (Dev.).

Terebratula rectirostra Hall, Thirteenth Rep. New York State Cab. Nat. Hist., 1860, p. 88.

Cryptonella rectirostra Hall, Fourteenth Rep. New York State Cab. Nat. Hist., 1861, p. 101;—Sixteenth Rep. Ibidem, 1863, p. 44;—Pal. New York, IV, 1867, p. 394, pl. 61, figs. 1–8.—Hall and Clarke, Ibidem, VIII, Pt. II, 1893, p. 286, pl. 80, figs. 1–4.

Loc. Bellona, York, Moscow, etc., New York; Falls of Ohio.

Cryptonella subelliptica Hall and Clarke. Waverly (L. Carb.).

Cryptonella subelliptica Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 81, figs. 41–43.

Loc. Sciotoville, Ohio.

CYCLORHINA Hall and Clarke. Genotype Rhynchospira nobilis Hall.

Cyclorhina Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 206;—Thirteenth Ann. Rep. New York State Geologist, 1895, p. 830.

Cyclorhina nobilis Hall. Hamilton (Dev.).

Rhynchospira nobilis Hall, Thirteenth Rep. New York State Cab. Nat. Hist., 1860, p. 83.

Rhynchospira and Trematospira? nobilis Hall, Pal. New York, IV, 1867, pp. 277, 412, pl. 63, figs. 33–36.

Retzia (Trematospira) nobilis Whiteaves, Cont. Canadian Pal., I, 1889, p. 116.

Cyclorhina nobilis Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 207, pl. 61, figs. 1–12.

Loc. Darien, New York; Thedford, Ontario.

CYCLOSPIRA Hall and Clarke. Genotype Orthis bisulcata Emmons.

Cyclospira Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 146.—Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 469.—Hall and Clarke, Thirteenth Ann. Rep. New York State Geologist, 1895, p. 808.

Cyclospira bisulcata (Emmons). Trenton (Ord.).

Orthis bisulcata Emmons, Geol. New York; Rep. Second Dist., 1842, p. 396, fig. 4.

Atrypa bisulcata Hall, Pal. New York, I, 1847, p. 139, pl. 33, fig. 3.

Genus? bisulcata Hall, Twelfth Rep. New York State Cab. Nat. Hist., 1859, p. 65.

Camarella bisulcata Miller, American Pal. Foss., 1877, p. 107.

Camarella owatonnensis Sardeson, Bull. Minnesota Acad. Nat. Sci., III, 1892, p. 328, pl. 4, figs. 1–3.

Cyclospira bisulcata? Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 470, pl. 34, figs. 49–54.

Cyclospira bisulcata Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 147, figs. 133–136; pl. 54, figs. 38–40;—Whiteaves, Pal. Foss., III, Pt. III, 1897, p. 180.

Loc. Adams, Jefferson County, New York; Ottawa, Canada; Cannon Falls, etc., Minnesota; Lake Winnipeg, Manitoba.

Cyclospira(?) sparsiplica Foerste. Clinton (Sil.).

Cyclospira? sparsiplica Foerste, Geol. Ohio, VII, 1895, p. 593, pl. 37A, fig. 18.

Loc. Dayton, Ohio.

Obs. May be a species of Parastrophia or a rhynchonelloid.

CYRTIA Dalman. Genotype Anomites exporrectus Wahlenberg.

Cyrtia Dalman, Kongl. Svenska Vet.-Akad. Handl., för 1827, 1828, pp. 93, 97.—Billings, Canadian Jour., VI, 1861, p. 262.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 93.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 40;—Thirteenth Ann. Rep. New York State Geologist, 1895, p. 759.

Cyrtia acutirostris Shumard=Cyrtina acutirostris.

Cyrtia alta Hall. Waverly (L. Carb.).

Spirifer alta Hall, Proc. American Phil. Soc., X, 1866, p. 246;—Pal. New York, IV, 1867, p. 248, pl. 43, figs. 1–7.

Syringothyris alta Schuchert, Ninth Ann. Rep. New York State Geol., 1890, p. 35.

Cyrtia alta Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 42, pl. 26, figs. 1–5; pl. 39, figs. 37, 38.

Loc. Meadville, Pennsylvania; Bedford, Ohio.

Cyrtia biplicata Hall=Cyrtina biplicata.

Cyrtia curvilineata White=Cyrtina curvilineata.

Cyrtia cyrtiniformis (Hall and Whitfield). Chemung (Dev.).

Spirifera cyrtinaformis Hall and Whitfield, Twenty-third Rep. New York State Cab. Nat. Hist., 1872, p. 238, pl. 11, figs. 21–24;—Extract, 1872, p. 19, pl. 11, figs. 21–24.—Whiteaves, Cont. to Canadian Pal., I, 1891, p. 222.

Cyrtia cyrtiniformis Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 42, pl. 25, figs. 26–32.

Loc. Rockford, Iowa; Hay River, Canada.

Obs. Compare with C. norwoodi Meek.

Cyrtia dalmani Hall=Cyrtina dalmani.

Cyrtia exporrecta (Wahlenberg). Niagara (Sil.).

Anomites exporrectus Wahlenberg, Nova Acta Regiæ Soc. Scient. Upsal, VIII, 1821, p. 64.

Spirifera (Cyrtia) trapezoidalis Hall and Whitfield, Twenty-fourth Rep. New York State Cab. Nat. Hist., 1872, p. 183.

Cyrtia trapezoidalis Hall and Whitfield, Twenty-seventh Rep. Ibidem, 1875, pl. 9, figs. 19–21.

Cyrtia exporrecta Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 93, pl. 27, figs. 6–8, 20.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 42, pl. 28, figs. 1, 48, 49, 51.

Loc. Europe; Louisville, Kentucky.

Cyrtia exporrecta arrecta Hall and Whitfield=C. myrtea.

Cyrtia gigas Troost=Syringothyris gigas.

Cyrtia hamiltonensis Hall=Cyrtina hamiltonensis.

Cyrtia meta (Hall). Clinton and Niagara (Sil.).

Spirifer radiatus (pars) Hall, Pal. New York, II, 1852, p. 66, pl. 22, figs. 2a–2c, 2f.

Spirifera meta Hall, Twentieth Rep. New York State Cab. Nat. Hist., 1867, p. 372, pl. 13, figs. 12, 13.

Cyrtia radians Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pp. 42, 362, pl. 28, figs. 4, 5, 50, 52; pl. 39, fig. 33.

Loc. Lockport and Rochester, New York; Milwaukee, Wisconsin.

Cyrtia missouriensis Swallow=Cyrtina missouriensis.

Cyrtia myrtia Billings. Anticosti and Niagara (Sil.).

Cyrtia myrtia Billings, Pal. Fossils, I, 1862, p. 165, fig. 149.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 42.

Cyrtia trapezoidalis var. arrecta Hall and Whitfield, Twenty-fourth Rep. New York State Cab. Nat. Hist., 1872, p. 183.

Cyrtia exporrecta Hall and Whitfield, Twenty-seventh Rep. Ibidem, 1875, pl. 9, figs. 22, 23.

Cyrtia exporrecta var. arrecta Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 94, pl. 27, fig. 21; pl. 34, fig. 35; pl. 37, figs. 60, 61.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 28, figs. 2, 3; pl. 39, fig. 32.

Loc. Anticosti; Louisville, Kentucky.

Cyrtia norwoodi (Meek). Middle Devonian.

Spirifera norwoodi Meek, Proc. Acad. Nat. Sci. Philadelphia, 1860, p. 308.

Spirifera utahensis Meek, note appended to extra copies of the above-cited paper, 1860;—Simpson's Rep. Expl. Great Basin Terr. Utah, 1876, p. 345, pl. 1, fig. 4;—King's U. S. Geol. Expl. 40th Parl., IV, 1877, p. 39, pl. 3, fig. 1.

Loc. Buell Valley, Utah.

Obs. Compare with C. crytiniformis Hall and Whitfield.

Cyrtia occidentalis Swallow=Cyrtina occidentalis.

Cyrtia radians Hall and Clarke=C. meta.

Cyrtia rostrata Hall=Cyrtina rostrata.

Cyrtia trapezoidalis Hisinger=C. exporrecta.

Cyrtia trapezoidalis arrecta Hall and Whitfield=C. myrtia.

Cyrtia triquetra Hall=Cyrtina triquetra.

Cyrtia umbonata Hall=Cyrtina umbonata.

CYRTINA Davidson. Genotype Cyrtia heteroclita Defrance.

Cyrtina Davidson, Mon. British Carb. Brachiopoda, Pal. Soc., 1858, p. 66.—Hall, Pal. New York, IV, 1867, p. 263;—Twentieth Rep. New York State Cab. Nat. Hist., 1867, p. 251.—Herrick, Bull. Dennison Univ., IV, 1888, p. 14.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 95.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 43;—Thirteenth Ann. Rep. New York State Geologist, 1895, p. 763.

Cyrtina acutirostris (Shumard). Chouteau (L. Carb.).

Cyrtia acutirostris Shumard, Geol. Rep. Missouri, 1855, p. 204, pl. C, fig. 3.

Cyrtina acutirostris Miller, N. American Geol. Pal., 1889, p. 342.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 28, figs. 38–42, 44, 54.—Keyes Geol. Survey Missouri, V, 1895, p. 89, pl. 39, fig. 10.

Loc. Hannibal and Louisiana, Missouri.

Cyrtina affinis Billings. Oriskany (Dev.)

Cyrtina dalmani Billings, Canadian Nat. Geol., VIII, 1863, p. 37.

Cyrtina affinis Billings, Pal. Fossils, II, 1874, p. 49, pl. 3A, fig. 6.

Loc. Grand Greve, Gaspé.

Cyrtina billingsi Meek. Hamilton (Dev.).

Cyrtina billingsi Meek, Trans. Chicago Acad. Sci., I, 1868, p. 97, pl. 14, fig. 6.—Whiteaves, Cont. to Canadian Pal., I, 1891, p. 227.

Loc. Clearwater and Athabasca rivers, British America.

Cyrtina biplicata Hall. Upper Helderberg (Dev.).

Cyrtia biplicata Hall, Tenth Rep. New York State Cab. Nat. Hist., 1857, p. 165.

Cyrtina biplicata Hall, Pal. New York, IV, 1867, p. 266, pl. 27, figs. 5–10.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 28, figs. 7–10.

Loc. Albany and Schoharie counties, etc., New York; Michigan.

Cyrtina burlingtonensis Rowley. Burlington (L. Carb.).

Cyrtina burlingtonensis Rowley, American Geologist, XII, 1893, p. 308, pl. 14, figs. 15–17.

Loc. Louisiana, Missouri.

Obs. Compare with C. neogenes.

Cyrtina crassa Hall. Corniferous (Dev.).

Cyrtina crassa Hall, Pal. New York, IV, 1867, p. 267, pl. 27, figs. 11, 12.—Hall and Whitfield, Twenty-seventh Rep. New York State Cab. Nat. Hist., 1875, pl. 9, figs. 14–16.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 95, pl. 13, figs. 21–24.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 28, figs. 13–15.

Loc. Vienna, New York; Falls of Ohio.

Cyrtina(?) curupira Rathbun. Middle Devonian.

Cyrtina(?) curupira Rathbun, Bull. Buffalo Soc. Nat. Sci., I, 1874, p. 242, pl. 10, figs 1, 6.

Loc. Erere, Province of Para, Brazil.

Cyrtina curvilineata White. Hamilton (Dev.).

Cyrtia curvilineata White, Proc. Boston Soc. Nat. Hist., IX, 1862, p. 25.

Cyrtina curvilineata? Hall, Pal. New York, IV, 1867, p. 270, pl. 44, figs. 53–55.

Cyrtina curvilineata Hall and Clarke, Ibidem, VIII, Pt. II, 1895, pl. 28, figs. 11, 12

Loc. Iowa City, Iowa.

Cyrtina dalmani Billings (non Hall)=C. affinis.

Cyrtina dalmani (Hall). Lower Helderberg (Dev.).

Cyrtia dalmani Hall, Tenth Rep. New York State Cab. Nat. Hist., 1857, p. 64;—Pal. New York, III, 1859, p. 206, pl. 24, fig. 1.

Cyrtina dalmani Meek and Worthen, Geol. Survey Illinois, III, 1868, p. 383, pl. 7, fig. 3.

Loc. Albany and Schoharie counties, New York; Perry County, Missouri; Decatur County, Tennessee; Dalhousie, New Brunswick.

Cyrtina davidsoni Walcott. Middle and Upper Devonian.

Cyrtina davidsoni Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 146, pl. 3, fig. 2.

Loc. White Pine district, Nevada.

Cyrtina hamiltonensis Hall. Up. Helderberg, Ham., and Port. (Dev.).

Cyrtia hamiltonensis Hall, Tenth Rep. New York State Cab. Nat. Hist., 1857, p. 166.—Billings, Canadian Jour., VI, 1861, p. 262, figs. 80–82;—Geol. Canada, 1863, p. 384, fig. 415.

Cyrtina hamiltonensis Hall, Pal. New York, IV, 1867, p. 268, pl. 27, figs. 1–4; pl. 44, figs. 26–33, 38–52.—Meek, Trans. Chicago Acad. Sci., I, 1868, p. 99, pl. 14, figs. 5, 7, 10.—Nicholson, Pal. Prov. Ontario, 1874, p. 83.—Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 147.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 96, pl. 13, figs. 4–12.—Whiteaves, Cont. to Canadian Pal., I, 1891, pp. 226, 288.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 28, figs. 23–33, 43, 45, 46, 53.—Kindle, Bull. American Pal., 6, 1896, p. 35.

Cyrtina panda Meek, Trans. Chicago Acad. Sci., I, 1868, p. 100, pl. 14, fig. 8.

Loc. New York; Pennsylvania; Maryland; Cayuga and Thedford, Ontario; Louisville, Kentucky; Independence, Iowa; Eureka district, Nevada; Mackenzie and Athabasca rivers, and lakes Manitoba and Winnipegosis, British America.

Obs. C. panda is a variation of this species with a higher ventral area.

Cyrtina hamiltonensis recta Hall. Hamilton and Chemung (Dev.).

Cyrtina hamiltonensis var. recta Hall, Pal. New York, IV, 1867, p. 270, pl. 44, figs. 34–37.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 97, pl. 13, figs. 13–16.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 28, figs. 21, 22.

Loc. Allegany County, New York; Falls of Ohio.

Cyrtina lachrymosa Hall and Clarke. Waverly (L. Carb.).

Cyrtina lachrymosa Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pp. 46, 362, pl. 28, figs. 36, 37, 47.

Loc. Richfield, Ohio.

Cyrtina missouriensis (Swallow). Hamilton (Dev.).

Cyrtia missouriensis Swallow, Trans. St. Louis Acad. Sci., I, 1860, p. 647.

Cyrtina missouriensis Miller, N. American Geol. Pal., 1889, p. 343.

Loc. Callaway County, Missouri.

Obs. Regarded by Keyes as a synonym for C. umbonata.

Cyrtina neogenes Hall and Clarke. Burlington (L. Carb.).

Cyrtina neogenes Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 84, fig. 41.
Loc. Burlington, Iowa.
Obs. Compare with C. burlingtonensis.

Cyrtina(?) occidentalis (Swallow). Hamilton (Dev.).

Cyrtia occidentalis Swallow, Trans. St. Louis Acad. Sci., I, 1860, p. 648.
Cyrtina? occidentalis Miller, N. American Geol. Pal., 1889, p. 343.
Syringothyris occidentalis Keyes, Geol. Survey Missouri, V, 1889, p. 86.
Loc. Callaway County, Missouri.
Obs. This is probably a Spirifer with a high area as in S. asperus, or it is a Cyrtia.

Cyrtina panda Meek=C. hamiltonensis.

Cyrtina pyramidalis (Hall). Niagara (Sil.).

Spirifer pyramidalis Hall, Pal. New York, II, 1852, p. 266, pl. 54, fig. 7.
Cyrtina pyramidalis Miller, N. American Geol. Pal., 1889, p. 343.
Loc. Lewiston, New York.

Cyrtina rostrata Hall. Oriskany and Corniferous (Dev.).

Cyrtia rostrata Hall, Tenth Rep. New York State Cab. Nat. Hist., 1857, p. 64;—Pal. New York, III, 1859, p. 429, pl. 96, figs. 1-6; pl. 98, fig. 8.—Billings, Canadian Jour., VI, 1861, p. 263.
Cyrtina rostrata Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 25, figs. 1-8; pl. 28, fig. 6.
Loc. Albany County, New York; Cumberland, Maryland; Cayuga, Ontario.

Cyrtina triplicata Simpson. Waverly (L. Carb.).

Cyrtina triplicata Simpson, Trans. American Phil. Soc., n. ser., XVI, 1889, p. 439, fig. 4.
Loc. Warren, Pennsylvania.

Cyrtina triquetra (Hall). Hamilton (Dev.).

Cyrtia triquetra Hall, Geol. Survey Iowa, I, Pt. II, 1858, p. 513.
Cyrtina triquetra Meek, Trans. Chicago Acad. Sci., I, 1868, p. 99.—Meek and Worthen, Geol. Survey Illinois, III, 1868, p. 436, pl. 13, fig. 4.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 28, figs. 14, 35.
Loc. Rock Island, Illinois.

Cyrtina umbonata (Hall). Hamilton (Dev.).

Cyrtia umbonata Hall, Geol. Survey Iowa, I, Pt. II, 1858, p. 512, pl. 5, fig. 2.
Cyrtina umbonata Miller, N. American Geol. Pal., 1889, p. 343.—Keyes, Geol. Survey Missouri, V, 1895, p. 90.
Loc. Buffalo, Iowa; Rock Island, Illinois; Callaway County, Missouri.
Obs. See C. missouriensis.

Cyrtina umbonata alpenaensis Hall and Clarke. Hamilton (Dev.).

Cyrtina umbonata var. alpenensis Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, p. 362, pl. 28, figs. 16-20.
Loc. Alpena, Michigan.

DALMANELLA Hall and Clarke.

Genotype Orthis testudinaria Dalman.

Orthis (group of O. testudinaria) Hall, Bull. Geol. Soc. America, I, 1889, p. 21.
Dalmanella Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 205, 223.—Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 439.—Hall and Clarke, Eleventh Ann. Rep. New York State Geologist, 1894, p. 170.

Dalmanella amœna N. H. Winchell. Trenton (Ord.).

Orthis amœna Winchell, Eighth Ann. Rep. Geol. Nat. Hist. Survey Minnesota, 1880, p. 65.

Orthis (D.) amœna Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 453, pl. 33, figs. 48–50.

Loc. Spring Valley, Minnesota.

Dalmanella arcuaria Hall and Clarke. Niagara (Sil.).

Dalmanella arcuaria Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 224, 341, pl. 5C, figs. 20, 21.

Loc. Perry County, Tennessee.

Dalmanella bellula (Meek). Lorraine (Ord.).

Orthis bellula (James MS.) Meek, Pal. Ohio, I, 1873, p. 103, pl. 8, fig. 5; Miller, Cincinnati Quart. Jour. Sci., II, 1875, p. 31.

Dalmanella bellula Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 224.

Loc. Cincinnati, Ohio.

Dalmanella concinna Hall. Lower Helderberg (Dev.).

Orthis concinna Hall, Pal. New York, III, 1859, p. 172, pl. 13, figs. 1–3.

Dalmanella concinna Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 207, 224.

Loc. Cumberland, Maryland.

Dalmanella crispata (Emmons). Lorraine (Ord.).

Orthis crispata Emmons, Geol. New York; Rep. Second Dist., 1842, p. 404, fig. 5.

Dalmanella crispata Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 224.

Loc. Lorraine, New York.

Dalmanella devonica (Walcott). Lower Devonian.

Skenidium devonicum Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 116, pl. 13, fig. 4.

Loc. Eureka district, Nevada.

Obs. The type specimen has no spondylium and therefore is no Scenidium.

Dalmanella electra (Billings). Calciferous (Ord.).

Orthis electra Billings, Pal. Fossils, I, 1862, p. 79, fig. 72; p. 217;—Geol. Canada, 1863, p. 231, fig. 246.

Orthis electra? White, Wheeler's Rep. Geol. Geogr. Expl. west 100 Merid., IV, 1875, p. 55.

Dalmanella electra Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 223.

Loc. Point Levis and St. John, Canada; Newfoundland; House Range, Utah.

Dalmanella electra major (Matthew). Calciferous (Ord.).

Orthis electra var. major Matthew, Trans. Royal Soc. Canada, X, 1893, p. 100, pl. 7, fig. 3.

Loc. Near St. John, New Brunswick.

Dalmanella electra lævis (Matthew). Calciferous (Ord.).

Orthis electra var. lævis Matthew, Trans. Royal Soc. Canada, X, 1893, p. 100.

Loc. Near St. John, New Brunswick.

Dalmanella elegantula (Dalman). Clinton and Niagara (Sil.).

Orthis elegantula Dalman, Kongl. Svenska Vet.-Akad. Handl., för 1827, 1828, p. 117, pl. 2, fig. 6.—Hall, Pal. New York, II, 1852, p. 252, pl. 52, fig. 3.—Billings, Canadian Nat. Geol., I, 1856, p. 136, pl. 2, fig. 5.—Roemer, Sil. Fauna west. Tennessee, 1860, p. 62, pl. 5, fig. 7.—Billings, Geol. Canada, 1863, p. 312, fig. 320.—Hall, Twenty-eighth Rep. New York State Mus. Nat. Hist., 1879, p. 150, pl. 21, figs. 11–17;—Eleventh Rep. State Geol. Indiana, 1882, p. 285, pl. 21, figs. 11–17;—Second Ann. Rep. New York State Geol., 1883,

Dalmanella elegantula (Dalman)—Continued.

pl. 35, figs. 34–37.—Foerste, Bull. Denison Univ., I, 1885, p. 84, pl. 13, fig. 1.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 37, pl. 32, figs. 52–57.—Beecher and Clarke, Mem. New York State Mus., I, 1889, p. 14, pl. 1, figs. 3–12.—Foerste, Proc. Boston Soc. Nat. Hist., XXIV, 1890, p. 307.

Orthis canalis Hall, Geol. New York; Rep. Fourth Dist., 1843, p. 105, fig. 6.

Orthis elegantula? var. Hall, Pal. New York, II, 1852, p. 57, pl. 20, fig. 7.

Dalmanella elegantula Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 207, 224, pl. 5C, figs. 15–19.

Orthis (Dalmanella) elegantula Foerste, Geol. Ohio, VII, 1895, p. 581, pl. 25, figs. 11, 17.

Loc. Europe; New York; Ohio; Indiana; Kentucky; Tennessee; Missouri; Ontario and Nova Scotia, Canada; Collinsville, Alabama.

Dalmanella elegantula parva (Foerste). Clinton (Sil.).

Orthis elegantula var. parva Foerste, Bull. Denison Univ., I, 1885, p. 85, pl. 13, fig. 17.

Dalmanella elegantula var. parva Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 224.

Loc. Dayton, Ohio.

Dalmanella(?) evadne (Billings). Calciferous (Ord.).

Orthis evadne Billings, Pal. Fossils, I, 1862, p. 81, fig. 74; p. 79.—Whitfield, Bull. American Mus. Nat. Hist., I, 1886, p. 300, pl. 24, fig. 8.

Dalmanella? evadne Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 223, pl. 5B, figs. 25, 26.

Loc. Point Levis, Canada; Fort Cassin, Vermont.

Dalmanella hamburgensis (Walcott). Pogonip and Trenton (Ord.).

Orthis hamburgensis Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 73, pl. 2, fig. 5.

Orthis (Dalmanella) hamburgensis? Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 440, pl. 33, figs. 14–16.

Loc. Pogonip group, Eureka district, Nevada. In the Trenton at St. Paul, Cannon Falls, etc., Minnesota; Highbridge, Kentucky.

Dalmanella infera (Calvin). Chemung (Dev.).

Orthis infera Calvin, Bull. U. S. Geol. Survey Terr., IV, 1878, p. 728.

Dalmanella infera Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 224.

Loc. Independence, Iowa; Naples, New York.

Dalmanella lenticularis (Vanuxem). Corniferous (Dev.).

Orthis lenticularis Vanuxem (non Wahlenberg), Geol. New York; Rep. Third Dist., 1842, p. 139, fig. 4.—Hall, Pal. New York, IV, 1867, p. 35, pl. 5, figs. 1, 2.

Orthis lenticularis and O. lentiformis Hall, Geol. New York; Rep. Fourth Dist., 1843, p. 175, fig. 4.

Orthis eboracensis Miller, N. American Geol. Pal., 1889, p. 357.

Dalmanella lenticularis Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 207, 224, pl. 5C, figs. 36–41.

Loc. Leroy, Caledonia, etc., New York.

Dalmanella lepida Hall. Hamilton (Dev.).

Orthis lepidus Hall, Thirteenth Rep. New York State Cab. Nat. Hist., 1860, p. 78;—Pal. New York, IV, 1867, p. 46, pl. 6, fig. 1.

Dalmanella lepida Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 207, 224.

Loc. Ontario County, New York.

Dalmanella macleodi (Whitfield). Calciferous (Ord.).

Orthis macleodi Whitfield, Bull. American Mus. Nat. Hist., II, 1889, p. 43, pl. 7, figs. 1–4.

Dalmanella macleodi Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 224.

Loc. Beekmantown, New York.

Dalmanella melita (Hall and Whitfield). Upper Cambrian.

Leptæna melita Hall and Whitfield, King's U. S. Geol. Survey, 40th Parl., IV, 1877, p. 208, pl. 1, figs. 13, 14.—Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 22.

Loc. Eureka district, Nevada.

Obs. This species is related to D. evadne (Billings).

Dalmanella(?) nettoana (Rathbun). Middle Devonian.

Orthis nettoana Rathbun, Bull. Buffalo Soc. Nat. Sci., I, 1874, p. 247, pl. 10, figs. 7, 10, 13;—Proc. Boston Soc. Nat. Hist., XX, 1879, p. 22.

Loc. Province of Para, Brazil.

Dalmanella parva (de Verneuil). Anticosti (Sil.).

Orthis parva (Pander) de Verneuil, Geology of Russia and the Ural Mountains, 1845, p. 188, pl. 13, fig. 3.—Billings, Cat. Sil. Foss. Anticosti, 1866, p. 41.

Loc. Europe; Anticosti.

Dalmanella perelegans Hall. Lower Helderberg (Dev.).

Orthis perelegans Hall, Tenth Rep. New York State Cab. Nat. Hist., 1857, p. 44, fig. 1;—Pal. New York, III, 1859, p. 171, pl. 13, figs. 4–12;—Second Ann. Rep. New York State Geol., 1883, pl. 35, figs. 32, 33.

Dalmanella perelegans Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 207, 224, pl. 5C, figs. 34, 35.

Loc. Albany and Schoharie counties, New York; Decatur County, Tennessee.

Dalmanella planiconvexa Hall. Lower Helderberg and Oriskany (Dev.).

Orthis planoconvexa Hall, Pal. New York, III, 1859, p. 168, pl. 12, figs. 1–6.

Dalmanella planoconvexa Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 207, 224.

Loc. Albany County, New York; Cumberland, Maryland.

Dalmanella(?) plicifera (Hall). Chazy (Ord.).

Leptæna plicifera Hall, Pal. New York, I, 1847, p. 19, pl. 4 bis, fig. 1.

Strophomena plicifera Hall, Twelfth Rep. New York State Cab. Nat. Hist., 1859, p. 70.

Loc. Chazy, New York.

Dalmanella pogonipensis (Hall and Whitfield). Pogonip (Ord.).

Orthis pogonipensis Hall and Whitfield, King's U. S. Geol. Expl. 40th Parl., IV, 1877, p. 232, pl. 1, figs. 9, 10.

Strophomena nemea H. and W., Ibidem, 1877, p. 233, pl. 1, fig. 15.—Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 71.

Loc. White Pine and Eureka districts, Nevada.

Obs. These are shells of the D. perveta group. S. nemea is based on a dorsal valve of O. pogonipensis.

Dalmanella quadrans Hall. Lower Helderberg (Dev.).

Orthis quadrans Hall, Pal. New York, III; Corrigenda in vol. with plates, 1861, pl. 12, figs. 9–12.

Dalmanella quadrans Hall and Clarke, Ibidem, VIII, Pt. I, 1892, p. 224.

Loc. Catskill and Schoharie, New York.

Dalmanella stonensis (Safford). Trenton (Ord.).

Orthis stonensis Safford, Geol. Tennessee, 1869, p. 286.

Dalmanella stonensis Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 224, pl. 5C, figs. 4, 5.

Loc. Near Nashville, Tennessee.

Dalmanella subæquata (Conrad). Trenton (Ord.).

Orthis subæquata Conrad, Proc. Acad. Nat. Sci. Philadelphia, I, 1843, p. 333.—Hall, Pal. New York, I, 1847, p. 118, pl. 32, fig. 2;—Geol Wisconsin, I, 1862, p. 42, figs. 1-3, and p. 436;—Second Ann. Rep. New York State Geol., 1883, pl. 34, figs. 19–24.

Orthis minneapolis N. H. Winchell, Eighth Ann. Rep. Geol. Nat. Hist. Survey Minnesota, 1880, p. 63.

Orthis perveta Hall, Second Ann. Rep. New York State Geol., 1883, pl. 34, figs. 17, 18 (?16).

Dalmanella subæquata Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 194, 207, 224, pl. 5C, figs. 6–11.

Dalmanella perveta Hall and Clarke, Ibidem, 1892, p. 224, pl. 5C, figs. 13, 14.

Orthis (D.) subæquata Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 446, pl. 33, figs. 30–36.

Loc. Mineral Point, Wisconsin; Minneapolis, St. Paul, Cannon Falls, Fountain, etc., Minnesota; Decorah and McGregor, Iowa; Auburn, Lincoln County, Missouri; Montreal, Canada.

Dalmanella subæquata circularis N. H. Winchell. Trenton (Ord.).

Orthis circularis N. H. Winchell, Eighth Ann. Rep. Geol. Nat. Hist. Survey Minnesota, 1880, p. 66.

Orthis (D.) subæquata var circularis Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 452, pl. 33, figs. 46, 47.

Loc. Minneapolis, Cannon Falls, etc., Minnesota; Highbridge, Kentucky; Lebanon, Tennessee.

Dalmanella subæquata conradi N. H. Winchell. Trenton (Ord.).

Orthis conradi N. H. Winchell, Eighth Ann. Rep. Geol. Nat. Hist. Survey Minnesota, 1880, p. 68.

Orthis (D.) subæquata var. conradi Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 449, pl. 33, figs. 37–39.

Loc. Minneapolis, Minnesota; Decorah, Iowa; Janesville and Beloit, Wisconsin; Montreal, Canada; ?Eureka district, Nevada.

Dalmanella subæquata gibbosa (Billings). Chazy-Trenton (Ord.).

Orthis gibbosa Billings, Geol. Survey Canada; Rep. Progress for 1856, 1857, p. 296;—Canadian Nat. Geol., IV, 1859, p. 434.

Dalmanella gibbosa Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 224.

Orthis (D.) subæquata var. gibbosa Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 451, pl. 33, figs. 43–45.

Loc. Near Ottawa and Bellville, Canada; Minneapolis, Cannon Falls, etc., Minnesota; Decorah, Iowa; Mineral Point, Wisconsin; in the Chazy, Island of Montreal, and Pallideau Islands, Lake Huron.

Dalmanella subæquata pervetus (Conrad). Trenton (Ord.).

Orthis perveta Conrad, Proc. Acad. Nat. Sci. Philadelphia, I, 1843, p. 333.—Hall, Pal. New York, I, 1847, p. 120, pl. 32, fig. 5.—Billings, Canadian Nat. Geol., IV, 1859, p. 434, fig. 10.—Hall, Geol. Wisconsin, I, 1862, p. 42, fig. 7.—Billings, Geol. Canada, 1863, p. 130, fig. 57.

Orthis media N. H. Winchell, Eighth Ann. Rep. Geol. Nat. Hist. Survey Minnesota, 1880, p. 64.

Dalmanella subæquata pervetus (Conrad)—Continued.

Orthis kassubæ N. H. Winchell, Ibidem, 1880, p. 65.

?Orthis perveta Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 72, pl. 11, fig. 3.

Dalmanella perveta Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 5C, fig. 12.

Orthis (D.) subæquata var. perveta Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 450, pl. 33, figs. 40–42.

Loc. Mineral Point, Beloit, etc., Wisconsin; Minneapolis, St. Paul, Cannon Falls, etc., Minnesota; Decorah, Iowa; Dixon, Illinois; Tennessee.

Dalmanella subcarinata Hall. Lower Helderberg (Dev.).

Orthis subcarinata Hall, Tenth Rep. New York State Cab. Nat. Hist., 1857, p. 43, figs. 1, 2;—Pal. New York, III, 1859, p. 169, pl. 12, figs. 7, 8, 13–21 (not figs. 9–12=D. quadrans).—Meek and Worthen, Geol. Survey Illinois, III, 1868, p. 373, pl. 7, fig. 6.—Whitfield, Geol. Wisconsin, IV, 1882, p. 320, pl. 25, figs. 3, 4.—Hall, Second Ann. Rep. New York State Geol., 1883, pl. 35, figs. 23–31.

?Orthis subcarinata Tscherneyschew, Fauna Untern Devon des Urals, Mém. Com. Géol., Russia, IV, 1885, p. 57, pl. 7, fig. 97.

Dalmanella subcarinata Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 207, 224, pl. 5C, figs. 25–33.

Loc. Catskill, Schoharie, etc., New York; Perry and Pike counties, Missouri; Decatur County, Tennessee; Waubakee, Wisconsin; Arisaig, Nova Scotia (Ami); Russia.

Dalmanella superstes Hall and Clarke. Chemung (Dev.).

Dalmanella superstes Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 207, 224, 342, pl. 5C, figs. 44–47.

Loc. Near Howard, Steuben County, New York.

Dalmanella tenuilineata (Hall). Chemung (Dev.).

Atrypa? tenuilineata Hall, Geol. New York; Rep. Fourth Dist., 1843, p. 271, fig. 4.

Orthis leonensis Hall, Pal. New York, IV, 1867, p. 62, pl. 8, figs. 3–8.

Dalmanella leonensis Hall and Clarke, Ibidem, VIII, Pt. I, 1892, p. 224, pl. 5C, figs. 42, 43.

Loc. Leon, Conewango, etc., New York.

Dalmanella tersa (Sardeson). Lorraine (Ord.).

Orthis tersus Sardeson, Bull. Minnesota Acad. Nat. Sci., III, 1892, p. 331, pl. 5, figs. 11–13;—American Geol., XIX, 1897, p. 100, pl. 5, figs. 8–13.

Loc. Wilmington, Illinois; Nye, Wisconsin.

Dalmanella testudinaria (Dalman). Chazy-Lorraine (Ord.).

Orthis testudinaria Dalman, Kongl. Svenska Vet.-Akad. Handl., för 1827, 1828, p. 115, pl. 2, fig. 4.—Conrad, Ann. Rep. Geol. Survey New York, 1839, p. 63.—Hall, Pal. New York, I, 1847, p. 117, pl. 32, fig. 1; p. 288, pl. 79, fig. 4.—Billings, Canadian Nat. Geol., I, 1856, p. 40, fig. 1.—Rogers, Geol. Pennsylvania, II, Pt. II, 1858, p. 818, fig. 601.—Billings, Geol. Canada, 1863, p. 165, fig. 144.—Miller, Cincinnati Quart. Jour. Sci., II, 1875, p. 20.—Whitfield, Geol. Wisconsin, IV, 1882, p. 258, pl. 12, figs. 5–7.—Hall, Second Ann. Rep. New York State Geol., 1883, pl. 34, figs. 1–4, 6–13.—Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 72, pl. 11, fig. 10.—Sardeson, American Geol., XIX, 1897, p. 92.

Orthis striatula Emmons, Geol. New York; Rep. Second Dist., 1842, p. 394, fig. 3.

Orthis testudinaria? Emmons, Ibidem, 1842, p. 404, fig. 4.—White, Wheeler's Expl. Survey west 100 Merid., IV, 1875, p. 72.

Orthis disparilis Owen (non Conrad), Geol. Survey Wisconsin, Iowa, Minnesota, 1852, pl. 2B, fig. 23 (see specimens U. S. Nat. Mus., Cat. Invert. Foss., 17887).

Dalmanella testudinaria (Dalman)—Continued.

Dalmanella testudinaria Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 190, 206, 218, 224, pl. 5B, figs. 27-39.

Orthis rogata Sardeson, Bull. Minnesota Acad. Nat. Sci., III, 1892, p. 331, pl. 5, figs. 1-4;—American Geol., XIX, 1897, p. 95, pl. 4, figs. 1-10.

Orthis (Dalmanella) testudinaria Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 441, pl. 33, figs. 17-22.—Whiteaves, Pal. Foss., III, Pt. III, 1897, pp. 177, 241.

Loc. Europe; throughout the extent of the formations in America.

Dalmanella testudinaria emacerata Hall. Utica (Ord.).

Orthis emacerata Hall, Thirteenth Rep. New York State Cab. Nat. Hist., 1860, p. 121;—Fifteenth Rep. Ibidem, 1862, pl. 2, figs. 1-3.—Billings, Canadian Nat. Geol., VII, 1862, p. 393.—Miller, Cincinnati Quart. Jour. Sci., II, 1875, p. 24.—Hall, Second Ann. Rep. New York State Geol., 1883, pl. 34, figs. 14, 15.—Keyes, Geol. Survey Missouri, V, 1895, p. 58.—Sardeson, American Geol., XIX, 1897, p. 102, pl. 5, figs. 14, 18, 28.

Orthis cyclus James, Cincinnati Quart. Jour. Sci., I, 1874, p. 19.

Dalmanella emacerata Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 207, 224, pl. 5C, figs. 1, 2.

Orthis macrior Sardeson, Bull. Minnesota Acad. Nat. Sci., III, 1892, p. 330, pl. 5, figs. 5-7.

Orthis (D.) testudinaria var. emacerata Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 445, pl. 33, figs. 23, 24.

Loc. Cincinnati, Ohio; Spring Valley and Granger, Minnesota; Cape Girardeau, Missouri; St. Croix, Quebec, Canada.

Dalmanella testudinaria futilis (Sardeson). Trenton (Ord.).

Orthis futilis Sardeson, American Geol., XIX, 1897, p. 104, pl. 5, figs. 25-27.

Loc. Near Granger and Wykoff, Minnesota.

Dalmanella testudinaria ignota (Sardeson). Lorraine (Ord.).

Orthis ignota Sardeson, American Geol., XIX, 1897, p. 99, pl. 5, figs. 1-7.

Loc. Near Spring Valley, Minnesota.

Dalmanella testudinaria meeki (Miller). Lorraine (Ord.).

Orthis emacerata Meek (non Hall), Pal. Ohio, I, 1873, p. 109, pl. 8, figs. 1, 2

Orthis meeki Miller, Cincinnati Quart. Jour. Sci., II, 1875, p. 20.—Sardeson, American Geol., XIX, 1897, p. 98, pl. 4, figs. 24-29.

Orthis jugosa James, The Palæontologist, 4, 1879, p. 31.

Dalmanella meeki Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 206, 224, pl. 5C, fig. 3.

Orthis corpulenta Sardeson, Bull. Minnesota Acad. Nat. Sci., III, 1892, p. 330, pl. 5, figs. 8-10;—American Geol., XIX, 1897, p. 101, pl. 4, figs. 11-19.

Orthis (D.) testudinaria var. meeki Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 445, pl. 33, figs. 25-29.

Loc. Oxford, etc., Ohio; Spring Valley, Minnesota.

Dalmanella testudinaria multisecta (Meek). Utica (Ord.).

Orthis emacerata var. multisecta (James MS.) Meek, Pal. Ohio, I, 1873, p. 112, pl. 8, fig. 3.—Miller, Cincinnati Quart. Jour. Sci., II, 1875, p. 22.

Orthis multisecta Sardeson, American Geol., XIX, 1897, p. 97, pl. 4, figs. 20-23.

Dalmanella multisecta Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 207, 224.

Loc. Cincinnati, Ohio.

Dalmanella testudinaria porrecta (Sardeson). Trenton (Ord.).

Orthis porrecta Sardeson, American Geol., XIX, 1897, p. 104, pl. 5, figs. 19-24.

Loc. Near Granger, Minnesota.

DELTHYRIS Dalman. Genotype Delthyris elevata Dalman.

Delthyris Dalman, Kongl. Svenska Vet.-Akad. Handl., för 1827, 1828, pp. 93, 99.—Dall, American Jour. Conch., VI, 1870, p. 116.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pp. 9 and 16 under caption Septati (non p. 19).

Spirifera "lamellosa" Hall, Ninth Ann. Rep. New York State Geol., 1890, p. 11.

Obs. Specimens of D. elevata examined by the writer show a distinct median septum in the ventral valve.

Delthyris acanthoptera Conrad=Spirifer acanthopterus.

Delthyris acanthota Hall=Spirifer disjunctus.

Delthyris acuminata Conrad=Spirifer acuminatus.

Delthyris acuminata Hall (non Conrad)=D. mesicostalis.

Delthyris acutilirata Conrad=Platystrophia acutilirata.

Delthyris arenaria Vanuxem=Spirifer arenosus.

Delthyris arenosa Conrad=Spirifer arenosus.

Delthyris audacula Conrad=Spirifer audaculus.

Delthyris bialveata Conrad=Spirifer radiatus.

Delthyris biloba Conrad=Bilobites varicus.

Delthyris brachynota Hall=Platystrophia biforata.

Delthyris chemungensis Conrad=Spirifer disjunctus.

Delthyris congesta Hall=Spirifer granulosus.

Delthyris consobrina (d'Orbigny). Hamilton (Dev.).

Delthyris ziczac Hall (non Roemer), Geol. New York; Rep. Fourth Dist., 1843, p. 200, fig. 5.

Spirifera consobrina d'Orbigny, Prodrome Pal., I, 1850, p. 98.—Miller, N. American Geol. Pal., 1889, p. 372.

Spirifer clio Hall, Thirteenth Rep. New York State Cab. Nat. Hist., 1860, p. 94.

Spirifera ziczac Hall, Pal. New York, IV, 1867, p. 222, pl. 35, figs. 15–23;—Second Ann. Rep. New York State Geol., 1883, pl. 59, fig. 9; pl. 60, fig. 18.—Whitfield, Annals New York Acad. Sci., V, 1891, p. 554; pl. 11, fig. 13;—Geol. Ohio, VII, 1895, p. 448, pl. 7, fig. 13.

Spiriferina? ziczac Whitfield, Geol. Wisconsin, IV, 1882, p. 332, pl. 25, figs. 23, 24.

Spirifer consobrinus Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 34, figs. 9, 18; pl. 37, figs. 9, 10.

Loc. Moscow, York, Darien, etc., New York; Columbus, Ohio; Milwaukee, Wisconsin; Louisville, Kentucky.

Delthyris cuspidata Hall=Spirifer disjunctus.

Delthyris decemplicatus Hall=D. sulcata.

Delthyris disjuncta Hall=Spirifer disjunctus.

Delthyris duodenaria Hall=Spirifer duodenarius.

Delthyris duplicata Conrad=Spirifer duplicatus.

Delthyris euruteines Owen=Spirifer euruteines.

Delthyris expansa Owen=Pterotheca expansa, a Pteropod.

Delthyris fimbriata Conrad=Reticularia fimbriata.

Delthyris granulifera Hall=Spirifer granulosus.

Delthyris granulosa Conrad=Spirifer granulosus.

Delthyris inermis Hall=Spirifer disjunctus.

Delthyris lævis Hall=Reticularia lævis.

Delthyris lynx Hall=Platystrophia lynx and biforata.

Delthyris macronota Hall=Spirifer macronotus.

Delthyris macropleura Conrad=Spirifer macropleura.

Delthyris medialis Hall=Spirifer audaculus.

Delthyris mesicostalis Hall. Ithaca and Chemung (Dev.).

Delthyris mesacostalis Hall, Geol. New York; Rep. Fourth Dist., 1843, p. 269, fig. 9.

Delthyris acuminata Hall (non Conrad), Ibidem, 1843, p. 270, fig. 5.

Spirifera mesacostalis Hall, Pal. New York, IV, 1867, p. 240, pl. 40, figs. 1–3.

Spirifera mesacostalis? Hall, Second Ann. Rep. New York State Geol., 1883, pl. 59, figs. 32–34.

Spirifera mesacostalis var. acuminata Hall, Ibidem, 1883, figs. 27–31.

Spirifer mesacostalis Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 34, figs. 32–34.—Kindle, Bull. American Pal., 6, 1896, p. 35.

Loc. Ithaca, Philipsburg, Olean, etc., New York.

Delthyris mesastrialis Hall=Spirifer mesistrialis.

Delthyris mucronata Conrad=Spirifer pennatus.

Delthyris niagarensis Conrad=Spirifer niagaraensis.

Delthyris perlamellosa (Hall). Lower Helderberg (Dev.).

Spirifer perlamellosa Hall, Tenth Rep. New York State Cab. Nat. Hist., 1857, p. 57, figs. 1–5 on p. 58;—Pal. New York, III, 1859, p. 201, pl. 26, figs. 1, 2.—Billings, Geol. Canada, 1863, p. 957, fig. 455.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 35, figs. 7–13.

Delthyris macropleura Rogers (non Conrad), Geol. Pennsylvania, II, Pt. II, 1858, p. 825, fig. 643.

Spirifera perlamellosa Meek and Worthen, Geol. Survey Illinois, III, 1868, p. 384, pl. 7, fig. 9.—Hall, Second Ann. Rep. New York State Geol., 1883, pl. 60, figs. 5–13.

Spirifera perlamellosa? Keyes, Geol. Survey Missouri, V, 1895, p. 77.

Loc. Schoharie, Carlisle, etc., New York; Cumberland, Maryland; Pennsylvania; Square Lake, Maine; Perry County, Missouri; Decatur County, Tennessee.

Delthyris perlatus Conrad=Spirifer disjunctus.

Delthyris prolata Vanuxem=Spirifer disjunctus.

Delthyris prora Conrad=Spirifer acuminatus.

Delthyris radiatus Hall=Spirifer radiatus.

Delthyris raricosta Conrad. Upper Helderberg (Dev.).

Delthyris raricosta Conrad, Jour. Acad. Nat. Sci. Philadelphia, VIII, 1842, p. 262, pl. 14, fig. 18.

Delthyris undulatus Vanuxem, Geol. New York; Rep. Third Dist., 1842, p. 132, fig. 3.

Spirifer raricosta Billings, Canadian Jour., VI, 1861, p 258, figs. 71–73 on p. 259;—Geol. Canada, 1863, p. 372, fig. 392.—Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 135, pl. 4, fig. 2; pl. 14, fig. 12.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 35, figs. 5, 6, 14–17.

?Spirifer hesione Billings, Proc. Portland Soc. Nat. Hist., 1863, p. 117, pl. 3, fig. 17.

Spirifera raricosta Hall, Pal. New York, IV, 1867, p. 192, pl. 27, figs. 30–34; pl. 30, figs. 1–9.—Nicholson, Pal. Prov. Ontario, 1873, p. 82.—Billings, Pal. Fossils, II, 1874, p. 47, pl. 3A, fig. 5.—Hall, Second Ann. Rep. New York State Geol., 1883, pl. 60, figs. 14–17.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 128, pl. 17, figs. 38–42.

Loc. Schoharie, Caledonia, etc., New York; Columbus, Ohio; Falls of Ohio; Eureka district, Nevada; Port Colborne, Ontario; Square Lake, Maine; Grand Greve, Gaspé.

Delthyris rugatina Conrad=D. sulcata.

Delthyris(?) rugicosta (Hall). Arisaig (Sil.).

Spirifera rugæcosta Hall, Canadian Nat. Geol., V, 1860, p. 145.—Dawson, Acadian Geol., 3d ed., 1878, p. 596.

Loc. Arisaig, Nova Scotia.

Delthyris sculptilis Hall. Hamilton (Dev.).

Delthyris sculptilis Hall, Geol. New York; Rep. Fourth Dist., 1843, p. 202.

Spirifera sculptilis? Billings, Canadian Jour., VI, 1861, p. 262, fig. 79.

Spirifera sculptilis Billings, Geol. Canada, 1863, p. 386, fig. 423.—Hall, Pal. New York, IV, 1867, p. 221, pl. 35, figs. 10–14.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 132, pl. 31, fig. 13.

Spirifer sculptilis Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 37, fig. 8.

Loc. Ludlowville, York, etc., New York; Monroe County, Pennsylvania; Bosanquet, Ontario; Falls of Ohio.

Delthyris sinuatus Hall=Bilobites bilobus.

Delthyris staminea Hall=Spirifer crispus.

Delthyris sulcata Hisinger. Niagara (Sil.).

Delthyris sulcata Hisinger, Petref. Suecica, 1837, p. 73, pl. 21, fig. 8.

Delthyris rugatina Conrad, Jour. Acad. Nat. Sci. Philadelphia, VIII, 1842, p. 261.

Delthyris decemplicatus Hall, Geol. New York; Rep. Fourth Dist., 1843, p. 105, fig. 4.

Spirifer sulcatus Hall, American Jour. Sci., XX, 1849, p. 228;—Pal. New York, II, 1852, p. 261, pl. 54, fig. 2.—Billings, Canadian Nat. Geol., I, 1856, p. 137, pl. 2, fig. 7.—Hall, Second Ann. Rep. New York State Geol., 1883, pl. 60, figs. 1–4.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 35, figs. 1–4.

Loc. Europe; Lockport, Rochester, etc., New York; Hamilton, Ontario.

Obs. Davidson regards this species as synonymous with D. elevata Dalman, 1828.

Delthyris undulatus Vanuxem=D. raricosta.

Delthyris varica Conrad=Bilobites varicus.

Delthyris ziczac Hall=D. consobrina.

DERBYA Waagen. Genotype Derbya regularis Waagen.

Derbyia Waagen, Palæontologica Indica, Ser. XIII, I, 1884, pp. 576, 591.

Derbya Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 261;—Eleventh Ann. Rep. New York State Geologist, 1894, p. 286.

Derbya affinis Hall and Clarke. Upper Carboniferous.

Derbya affinis Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 349, pl. 11B, figs. 4, 5.

Loc. Near Kansas City, Missouri.

Derbya bennetti Hall and Clarke. Upper Carboniferous.

Derbya bennetti Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 263, 348, pl. 11A, figs. 34–39.

Loc. Near Kansas City, Missouri.

Derbya biloba Hall. Upper Carboniferous.

Streptorhynchus biloba Hall, Second Ann. Rep. New York State Geol., 1883, pl. 41, figs. 4, 5.

Derbya biloba Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 350, pl. 11, figs. 4, 5.

Loc. Winterset, Iowa.

Derbya broadheadi Hall and Clarke. Upper Carboniferous.

Derbya broadheadi Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 263, 347, pl. 11A, figs. 23, 24.

Loc. Near Kansas City, Missouri.

Derbya correanus (Derby). Upper Carboniferous.

Streptorhynchus correanus Derby, Bull. Cornell Univ., I, 1874, p. 32, pl. 6, fig. 11; pl. 7, figs. 1–4, 8, 10, 11–14, 17.—Hall, Second Ann. Rep. New York State Geol., 1883, pl. 41, figs. 18–22.

Derbya correanus Waagen, Palæontologica Indica, Ser. XIII, I, 1884, p. 592.

Derbya correana Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 262, pl. 11, figs. 18–22; pl. 20, figs. 10, 11.

Loc. Itaituba, Brazil.

Derbya(?) costatula Hall and Clarke. Kaskaskia (L. Carb.).

Derbya? costatula Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 346, pl. 11B, figs. 16, 17.

Loc. Crittenden County, Kentucky.

Derbya crassa (Meek and Hayden). Upper Carboniferous.

Orthis arachnoides Roemer (non Phillips), Kreidebildung Texas, 1852, p. 89, pl. 11, fig. 9.—Hall, Mexican Bound. Survey, 1857, pl. 20, fig. 3.

Orthisina crassa Meek and Hayden, Proc. Acad. Nat. Sci. Philadelphia, 1858, p. 261.

Orthis lasallensis McChesney, Descriptions New Pal. Fossils, 1860, p. 32;—Ibidem, 1865, pl. 1, fig. 6.

Orthis richmonda McChesney, Descriptions New Pal. Foss., 1860, p. 32;—Ibidem, 1865, pl. 1, fig. 5.

Hemipronites crassus Meek and Hayden, Pal. Upper Missouri, Smithsonian Cont. Knowl., XIV, 172, 1864, p. 26, pl. 1, fig. 7.—Meek, Final Rep. U. S. Geol. Survey Nebraska, 1872, p. 174, pl. 5, fig. 10; pl. 8, fig. 1.—Meek and Worthen, Geol. Survey Illinois, V, 1873, p. 570, pl. 25, fig. 12.—Herrick, Bull. Denison Univ., II, 1887, p. 50, pl. 2, fig. 19.

Orthis crenistria Geinitz (non Phillips), Carbon u. Dyas in Nebraska, 1866, p. 46, pl. 3, figs. 20, 21.

Hemipronites lasallensis McChesney, Trans. Chicago Acad. Sci., I, 1868, p. 28, pl. 1, fig. 6.

Hemipronites richmonda McChesney, Trans. Chicago Acad. Sci., I, 1868, p. 28, pl. 1, fig. 5.

Hemipronites crenistria White, Wheeler's Expl. Survey west 100 Merid., IV, 1875, p. 124, pl. 10, fig. 9.

Streptorhynchus richmondi Hall, Second Ann. Rep. New York State Geol., 1883, pl. 40, figs. 10, 11.

Hemipronites crassa White, Thirteenth Rep. State Geol. Indiana, 1884, p. 129, pl. 26, figs. 4–11.

Derbyia crassa Waagen, Palæontologica Indica, Ser. XIII, I, 1884, p. 592.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 262, pl. 10, figs. 10, 11; pl. 11A, figs. 28–33; pl. 11B, figs. 23, 24; pl. 20, figs. 12, 13.—Smith, Proc. American Phil. Soc., XXXV, 1897, p. 28 (extract).

Streptorhynchus crenistria Keyes, Proc. Acad. Nat. Sci. Philadelphia, 1888, p. 229;—Geol. Survey Missouri, V, 1895, p. 67, pl. 38, fig. 8.

Streptorhynchus crassum Miller, N. American Geol. Pal., 1889, p. 378.

?Streptorhynchus crassum Whitfield, Annals New York Acad. Sci., V, 1891, p. 580, pl. 13, figs. 11, 12;—Geol. Ohio, VII, 1893, p. 468, pl. 9, figs. 11, 12.

Loc. Leavenworth, Kansas; Nebraska City, Nebraska; Illinois; Missouri; Iowa; Ohio; Arkansas; Utah; Nevada; northern New Mexico; San Saba Valley, Texas.

Derbya cymbula Hall and Clarke. Upper Carboniferous.

Derbya cymbula Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 348, pl. 11B, figs. 2, 3.

Loc. Near Kansas City, Missouri.

Derbya kaskaskiaensis (McChesney). Kaskaskia (L. Carb.).

Orthis kaskaskiensis McChesney, Descriptions New Pal. Foss., 1860, p. 31.

Derbya kaskaskiensis Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 11B, fig. 6.

Loc. Kaskaskia, Chester, and Crittenden, Illinois.

Derbya keokuk Hall. Knobstone-Keokuk (L. Carb.).

Orthis crenistria Yandell and Shumard, Cont. Geol. Kentucky, 1847, pp. 19, 21.

Orthis keokuk Hall, Geol. Survey Iowa, I, Pt. II, 1858, p. 640, pl. 19, fig. 5.—Keyes, Geol. Survey Missouri, V, 1895, p. 63.

Streptorhynchus keokuk Hall, Second Ann. Rep. New York State Geol., 1883, pl. 41, figs. 1–3.

Streptorhynchus crenistria Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 279, pl. 18, fig. 14.

Derbya keokuk Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 262, pl. 11, figs. 1–3.

Loc. Keokuk, Iowa; Warsaw and Nauvoo, Illinois; New Providence, Indiana; Clark County, Missouri; Nevada.

Derbya pratteni (McChesney). Upper Carboniferous.

Orthis pratteni McChesney, Descriptions New Pal. Foss., 1860, p. 33.

Loc. Charbonier, Missouri.

Derbya robusta (Hall). Upper Carboniferous.

Orthis umbraculum? Owen (non Schloth.), Geol. Survey Wisconsin, Iowa, Minnesota, 1852, pl. 5, fig. 11 (see specimens in U. S. Nat. Mus., Cat. Invert. Foss., 17945).

Orthis robusta Hall, Geol. Survey Iowa, I, Pt. II, 1858, p. 743, pl. 28, fig. 5.

Streptorhynchus robusta Hall, Second Ann. Rep. New York State Geol., 1883, pl. 40, figs. 12–17.

Derbyia robusta Waagen, Palæontologica Indica, Ser. XIII, I, 1884, p. 592.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 262, pl. 10, figs. 12–17; pl. 11B, figs. 7, 8.

Loc. St. Clair County, Illinois.

Derbya ruginosa Hall and Clarke. Keokuk (L. Carb.).

Derbya ruginosa Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 346, pl. 11A, figs. 25–27.

Loc. New Providence, Indiana.

Dicellomus Hall=Obolella.

Dicellomus crassa Hall=Obolella crassa.

Dicellomus polita Hall=Obolella polita.

Dicœlosia King=Bilobites.

Dicraniscus Meek=Triplecia.

Dicraniscus ortoni Meek=Triplecia ortoni.

DICTYONELLA Hall. Genotype Rhynchonella? reticulata Hall.

Dictyonella Hall, Twentieth Rep. New York State Cab. Nat. Hist., 1867, p. 274.

Eichwaldia Hall, Ibidem, 1867, pp. 274–277, with figs.—Dall, American Jour. Conch., VI, 1870, p. 98.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 307;—Thirteenth Ann. Rep. New York State Geologist, 1895, p. 903.

Dictyonella anticostiensis (Billings). Anticosti (Sil.).

Eichwaldia anticostiensis Billings, Catalogue Sil. Foss. Anticosti, 1866, p. 10.

Loc. Anticosti.

Dictyonella concinna Hall. ?Niagara (Sil.).

Eichwaldia concinna Hall, Twentieth Rep. New York State Cab. Nat. Hist., 1867, p. 278.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 83, fig. 5.

Loc. Perry and Decatur counties, Tennessee.

Dictyonella corallifera Hall. Niagara (Sil.).

Atrypa corallifera Hall, Pal. New York, II, 1852, p. 281, pl. 58, fig. 5.

Eichwaldia corallifera Hall, Twentieth Rep. New York State Cab. Nat. Hist., 1867, p. 278.

Loc. Lockport and Rochester, New York.

Dictyonella gibbosa Hall. Niagara (Sil.).

Eichwaldia gibbosa Hall, Twentieth Rep. New York State Cab. Nat. Hist., 1867, p. 278.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 83, figs. 6, 7.

Loc. Perry and Decatur counties, Tennessee.

Dictyonella reticulata Hall. Niagara (Sil.).

Rhynchonella? reticulata Hall, Trans. Albany Institute, IV, 1863, p. 217.

Eichwaldia reticulata Hall, Twentieth Rep. New York State Cab. Nat. Hist., 1867, pp. 275–277, figs. 1–7;—Twenty-eighth Rep. Ibidem, 1879, p. 169, pl. 26, figs. 50–54;—Eleventh Rep. State Geol. Indiana, 1882, p. 312, pl. 26, figs. 50–54.—Foerste, Bull. Denison Univ., I, 1885, p. 91, pl. 13, fig. 4.—Beecher and Clarke, Mem. New York State Mus., I, 1889, p. 31, pl. 3, figs. 11–13.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 308, figs. 229–235; pl. 83, figs. 8–13.—Foerste, Geol. Ohio, VII, 1895, p. 594, pl. 25, fig. 4.

Loc. Waldron, Indiana; Dayton, Ohio; Wisconsin.

DIELASMA King. Genotype Terebratulites elongatus Schlotheim.

Epithyris King (non Phillips), Mon. Permian Foss., Pal. Soc., 1850, p. 46.—Dall, American Jour. Conch., VI, 1870, p. 103.

Dielasma King, Proc. Dublin Univ. Zool. Bot. Assoc., I, 1859, p. 260.—Beecher and Schuchert, Biol. Soc. Washington, VIII, 1893, pp. 71–82.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 293;—Thirteenth Ann. Rep. New York State Geologist, 1895, p. 863.

Dielasma bovidens (Morton). Upper Carboniferous.

Terebratula bovidens Morton, American Jour. Sci., XXIX, 1836, p. 150, pl. 2, fig. 4.—Meek, Final Rep. U. S. Geol. Survey, Nebraska, 1872, p. 187, pl. 1, fig. 7; pl. 2, fig. 4.—Meek and Worthen, Geol. Survey Illinois, V, 1873, p. 572, pl. 25, fig. 15.—White, Thirteenth Rep. State Geol. Indiana, 1884, p. 137, pl. 32, figs. 17–19.—Keyes, Geol. Survey Missouri, V, 1895, p. 105.

Terebratula bovidens? Hall, Geol. Survey Iowa, I, Pt. II, 1858, p. 711.—McChesney, Trans. Chicago Acad. Sci., I, 1869, p. 37, pl. 1, fig. 2.

Terebratula millipunctata Hall, Expl. Surveys R. R. Route Miss. River, Pacific Ocean, III, 1856, p. 101, pl. 2, figs. 1, 2;—Trans. Albany Institute, IV, 1858, p. 35.—Meek and Hayden, Proc. Acad. Nat. Sci. Philadelphia, 1859, p. 26.—White and St. John, Trans. Chicago Acad. Sci., I, 1868, p. 119.

Terebratula elongata Shumard (non Schlotheim), Trans. St. Louis Acad. Sci., I, 1859, p. 392.

Terebratula geniculosa McChesney, Descriptions New Pal. Foss., 1861, p. 82;—Ibidem, 1865, pl. 1, fig. 2.

Dielasma? bovidens White, Wheeler's Expl. Survey west 100 Merid., Prel. Rep., 1874, p. 21.

Dielasma bovidens (Morton)—Continued.

Terebratula (Dielasma) bovidens White, Ibidem, Final Rep., IV, 1875, p. 144, pl. 11, fig. 10.

Terebratula hastata Walcott (non Sowerby), Mon. U. S. Geol. Survey, VIII, 1884, p. 224.—Smith, Proc. American Phil. Soc., XXXV, 1897, p. 30.

Dielasma bovidens Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pp. 295, 296, fig. 213; pl. 81, figs. 29–35.

Loc. Putnam Hill, Ohio; Indiana; Illinois; Missouri; Iowa; Nebraska; Arkansas; New Mexico; Eureka district, Nevada; Guadalupe Mountains, Texas.

Dielasma burlingtonense White. Kinderhook (L. Carb.).

Terebratula burlingtonensa White, Jour. Boston Soc. Nat. Hist., VII, 1860, p. 228.

Terebratula (Dielasma) burlingtonensis White, Wheeler's Expl. Survey west 100 Merid., IV, 1875, p. 93.

Dielasma burlingtonensis Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 296, pl. 81, figs. 9–11.

Loc. Burlington, Iowa; Mountain Spring, Nevada.

Dielasma calvini (Hall and Whitfield). Chemung (Dev.).

Crpytonella eudora Hall and Whitfield (non Hall, 1867), Twenty-third Rep. New York State Cab. Nat. Hist., 1873, p. 225.

Cryptonella calvini Hall and Whitfield, Ibidem, 1873, p. 239.

?Cryptonella calvini Whiteaves, Cont. Canadian Pal., I, 1891, p. 235.

Dielasma calvini Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 296, pl. 80, figs. 20–22.

Loc. Hackberry Grove, Iowa; Mackenzie and Peace rivers, Canada.

Dielasma formosum Hall. Warsaw (L. Carb.).

Terebratula formosa Hall, Trans. Albany Institute, IV, 1858, p. 7.—Whitfield, Bull. American Mus. Nat. Hist., I, 1882, p. 55, pl. 6, figs. 59–64.—White, Eleventh Rep. State Geol. Indiana, 1882, p. 361, pl. 39, figs. 6–8.—Hall, Twelfth Rep. Ibidem, 1883, p. 337, pl. 29, figs. 59–64.

Dielasma formosa Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 296, pl. 81, figs. 12–26.

Loc. Bloomington and Spergen Hill, Indiana; Alton and Warsaw, Illinois; Caldwell County, Kentucky.

Dielasma gorbyi (Miller). Keokuk (L. Carb.).

Terebratula gorbyi Miller, Seventeenth Rep. State Geol. Indiana, 1891, p. 77, pl. 13, figs. 3, 4.

Loc. Edwardsville and Crawfordsville, Indiana.

Dielasma hochstetteri (Toula). Upper Carboniferous.

Terebratula hochstetteri Toula, Sitzb. der k. k. Akad. der Wissensch. zu Wien, LIX, 1869, p. 1, pl. 1, fig. 1.—Derby, Bull. Cornell Univ., I, 1874, p. 63.

Loc. Near Cochabamba, Bolivia.

Obs. Probably synonymous with D. bovidens (Morton).

Dielasma itaitubaense (Derby). Upper Carboniferous.

Terebratula itaitubensis Derby, Bull. Cornell Univ., I, 1874, p. 1, pl. 2, figs. 1, 3, 8, 16; pl. 3, fig. 24; pl. 6, fig. 15.

Dielasma itaitubensis Waagen, Palæontologica Indica, Ser. XIII, I, 1882, p. 348.—de Koninck, Annales du Musée Royal d'Histoire Naturelle de Belgique, XIV, 1887, p. 26, pl. 5, figs. 1–10, 45, 50.

Loc. Beach at Itaituba, Brazil; Belgium.

Dielasma obovatum Hall and Clarke. ?Upper Carboniferous.

Dielasma obovata Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 81, figs. 38-40.

Loc. Kentucky.

Dielasma occidentale (Miller). Chouteau (L. Carb.).

Terebratula occidentalis Miller, Eighteenth Ann. Rep. Geol. Survey Indiana, 1894, p. 313, pl. 9, figs. 10-13.

Loc. Sedalia, Missouri.

Dielasma(?) rowleyi (Worthen). Burlington (L. Carb.).

Terebratula rowleyi Worthen, Bull. Illinois State Mus. Nat. Hist., 2, 1884, p. 23;—Geol. Survey Illinois, VIII, 1890, p. 102, pl. 11, fig. 6.—Keyes, Geol. Survey Missouri, V, 1895, p. 105, pl. 40, fig. 15.

Dielasma rowleyi Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 296, pl. 81, figs. 27, 28.

Loc. Pike County, Missouri.

Dielasma sacculus (Martin). Upper Carboniferous.

Conchyliolithus anomites sacculus Martin, Petref. Derbesiana, 1809, tab. 46, figs. 1, 2.

Terebratula sacculus Dawson, Acadian Geol., 1855, p. 219, fig. 27.—Davidson, Quart. Jour. Geol. Soc. London, XIX, 1863, p. 169, pl. 9, figs. 1-3.—Dawson, Acadian Geol., 3d ed., 1878, p. 289, fig. 87.

Loc. Europe; Windsor, Nova Scotia.

Dielasma shumardianum (Miller). Kaskaskia (L. Carb.).

Terebratula arcuata Swallow (non Roemer, 1840), Trans. St. Louis Acad. Sci., II, 1863, p. 83.—Meek, Sixth Ann. Rep. U. S. Geol. Survey Terr., 1872, p. 470.

Terebratula shumardana Miller, American Pal. Foss., 2d ed., 1883, p. 299.

Loc. St. Genevieve County, Missouri; Chester, Illinois; near Virginia City, Montana.

Obs. Regarded by Meek and White as probably synonymous with D. bovidens (Morton).

Dielasma turgidum (Hall). Warsaw and St. Louis (L. Carb.).

Terebratula turgida Hall, Trans. Albany Institute, IV, 1858, p. 6.—Whitfield, Bull. American Mus. Nat. Hist., I, 1882, p. 54, pl. 6, figs. 53-58.—Hall, Twelfth Rep. State Geol. Indiana, 1883, p. 336, pl. 29, figs. 53-58.—Whitfield, Annals New York Acad. Sci., V, 1891, p. 586, pl. 13, figs. 21, 22;—Geol. Ohio, VII, 1895, p. 473, pl. 9, figs. 21, 22.

Dielasma turgida Beecher and Schuchert, Proc. Biol. Soc. Washington, VIII, 1893, p. 73, pl. 10, figs. 1-6.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 296, pl. 81, figs. 1-8.

Loc. Bloomington and Spergen Hill, Indiana; Crittenden County, Kentucky; Maxville and Newtonville, Ohio; Alton and Warsaw, Illinois; Pella, Iowa; Boonville, Missouri.

DIGNOMIA Hall. Genotype Lingula alveata Hall.

Dignomia Hall, Notes on some New or Imperfectly Known Forms among the Brach., 1872, p. 2, pl. 13, fig. 3;—Twenty-third Rep. New York State Cab. Nat. Hist., 1873, p. 245, pl. 13, fig. 3.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 14, 163;—Eleventh Ann. Rep. New York State Geologist, 1894, p. 230.

Dignomia alveata Hall. Hamilton (Dev.).

Lingula alveata Hall, Sixteenth Rep. New York State Cab. Nat. Hist., 1863, p. 23;—Pal. New York, IV, 1867, p. 12, pl. 2, figs. 14, 15.

Dignomia alveata Hall—Continued.

Dignomia alveata Hall, Notes on some New or Imperfectly Known Forms among the Brach., 1872, p. 2, pl. 13, fig. 3;—Twenty-third Rep. New York State Cab. Nat. Hist., 1873, pl. 13, fig. 3.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 14, pl. 1, figs. 24, 25.—Clarke, Thirteenth Ann. Rep. New York State Geologist, 1895, p. 187, pl. 4, fig. 1.

Loc. Canandaigua Lake, etc., New York.

DINOBOLUS Hall. Genotype Obolus conradi Hall.

Dinobolus Hall, Notes on some New or Imperfectly Known Forms among the Brach., (March) 1871, p. 4;—Ibidem, 1872, p. 4;—Twenty-third Rep. New York State Cab. Nat. Hist., 1873, p. 247.—Hall and Whitfield, Pal. Ohio, II, 1873, p. 130.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 36, 46, 164;—Eleventh Ann. Rep. New York State Geologist, 1894, p. 237.

Obolellina Billings, Canadian Nat. Geol., VI (December) 1871, p. 222;—Ibidem, VI, 1872, p. 326, figs. 1, 2;—American Jour. Sci., 3d ser., III, 1872, p. 270.

Conradia Hall (non Adams), Twenty-third Rep. New York State Cab. Nat. Hist, 1873, p. 250.—Davidson and King, Quart. Jour. Geol. Soc. London, XXX, 1874, p. 159.

Dinobolus canadaensis (Billings). Black River and Trenton (Ord.).

Obolus canadensis Billings, Canadian Nat. Geol., III, 1858, p. 441, fig. 20–23 (non fig. 19 = D. magnificus);—Geol. Survey Canada; Rep. Prog. for 1857, 1858, p. 189, figs. 20–23 (non fig. 19);—Geol. Canada, 1863, p. 142, figs. 75.

Obolellina canadensis Billings, Canadian Nat. Geol., VI, 1871, p. 222;—Ibidem, 1872, p. 326, fig. 15; fig. 6, p. 329.

Dinobolus canadensis Davidson and King, Quart. Jour. Geol. Soc. London, XXX, 1874, p. 162, pl. 19, fig. 7.

Loc. Pauquette Rapids, etc., Canada.

Dinobolus conradi Hall. Niagara (Sil.).

Obolus conradi Hall, Twentieth Rep. New York State Cab. Nat. Hist., 1868, p. 368, pl. 13, figs. 1, 2.

Obolus (Trimerella?) conradi Meek and Worthen, Geol. Survey Illinois, III, 1868, p. 351, pl. 5, fig. 7.

Trimerella conradi Dall, American Jour. Conch., VII, 1871, p. 83.

Dinobolus conradi Hall, Twenty-third Rep. New York State Cab. Nat. Hist., 1873, p. 247 (also extracts 1871, 1872).—Davidson and King, Quart. Jour. Geol. Soc. London, XXX, 1874, p. 160, pl. 18, figs. 1–5.—Hall and Whitfield, Pal. Ohio, II, 1875, p. 130, pl. 7, figs. 3, 4.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 38, pl. 4B, figs. 13–24.

Loc. Port Byron, Illinois; Leclaire, Iowa; Racine and Grafton, Wisconsin; Crawford, Ohio; England; Gotland.

Dinobolus magnificus (Billings). Black River-Trenton (Ord.).

Obolus canadensis Billings (partim), Geol. Surv. Canada, Rep. Prog. for 1857, 1858, p. 189, fig. 19 (non 20–23);—Canadian Nat. Geol., III, 1858, p. 441, fig. 19 (non figs. 20–23 = D. canadensis).

Obolellina magnificus Billings, Ibidem, n. ser., VI, 1872, p. 329, fig. 7.

Dinobolus magnificus Davidson and King, Quart. Jour. Geol. Soc. London, XXX, 1874, p. 164, pl. 19, fig. 8.—Nicholson, Pal. Prov. Ontario, 1875, p. 17, fig. 6.

Loc. Pauquette Rapids, etc., Canada.

Dinobolus(?) parvus Whitfield. Galena (Ord.).

Dinobolus? parvus Whitfield, Geol. Wisconsin, IV, 1882, p. 347, pl. 27, figs. 8–10.—Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 356, fig. 27.—Whiteaves, Pal. Foss., III, Pt. III, 1897, p. 166.

Loc. Whitewater, Wisconsin; Wykoff, Minnesota; Lake Winnipeg, Canada.

DINORTHIS Hall and Clarke. Genotype Orthis pectinella Emmons.

Dinorthis Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 195, 222.—Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 420.

Plæsiomys Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 196.

Dinorthis and Plæsiomys Hall and Clarke, Eleventh Ann. Rep. New York State Geologist, 1894, p. 266.

Dinorthis deflecta (Conrad.) Trenton (Ord.).

Strophomena deflecta Conrad, Proc. Acad. Nat Sci. Philadelphia, I, 1843, p. 332.—Hall, Twelfth Rep. New York State Cab. Nat. Hist., 1859, p. 70.

Strophomena recta Conrad, Proc. Acad. Nat. Sci. Philadelphia, I, 1843, p. 332.—Hall, Twelfth Rep. New York State Cab. Nat. Hist., 1859, p. 70.

Leptæna deflecta Hall, Pal. New York, I, 1847, p. 113, pl. 31B, fig. 5.

Leptæna recta Hall, Ibidem, 1847, p. 113, pl. 31B, fig. 6.

Streptorhynchus rectus Miller, American Pal. Foss., 1877, p. 134.

Streptorhynchus deflectum Miller, N. American Geol. and Pal., 1889, p. 378.

Plæsiomys deflecta Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 197, 222, pl. 5A, figs. 28–34.

Plæsiomys recta Hall and Clarke, Ibidem, 1892, pp. 197, 222.

Plæsiomys loricula Hall and Clarke, Ibidem, 1892, pp. 197, 341, pl. 5A, figs. 31–34.

Orthis (Dinorthis) deflecta Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 422, pl. 32, figs. 24–30.

Loc. Mineral Point, Beloit, Janesville, Wisconsin; Dixon, Illinois; Minneapolis, St. Paul, etc., Minnesota; McGregor, Iowa; central Tennessee; Highbridge, Kentucky.

Dinorthis fontinalis (White). Calciferous (Ord.).

Strophomena fontinalis White, Wheeler's Expl. and Survey west 100th Merid., IV, 1875, p. 54, pl. 3, fig. 4;—Prelim. Rep., p. 10, 1874.

Loc. Fish Spring, House Range, Utah.

Obs. Related to D. deflecta (Conrad).

Dinorthis iphigenia (Billings). Trenton (Ord.).

Orthis iphigenia Billings, Pal. Fossils, I, 1862, p. 133, pl. 110.

Plæsiomys iphigenia Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 222.

Loc. Ottawa, Canada.

Dinorthis meedsi Winchell and Schuchert. Trenton (Ord.).

Orthis meedsi Winchell and Schuchert, American Geol., IX, April 1, 1892, p. 289.

Orthis minnesotensis Sardeson, Bull. Minnesota Acad. Nat. Sci., III, April 9, 1892, p. 332, pl. 5, figs. 14–17.

Orthis (Dinorthis) meedsi Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 427, pl. 32, figs. 39–42.

Loc. Cannon Falls, Kenyon, Preston, etc., Minnesota; Decorah and McGregor, Iowa; Neenah and Oshkosh, Wisconsin.

Dinorthis meedsi germana Winchell and Schuchert. Trenton (Ord.).

Orthis meedsi var. germana Winchell and Schuchert, American Geol., IX, 1892, p. 290.

Orthis (D.) meedsi var. germana Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 428, pl. 32, figs. 43–45.

Loc. Cannon Falls, Kenyon, and Fountain, Minnesota.

Dinorthis pectinella (Emmons). Trenton (Ord.).

Orthis pectinella Emmons, Geol. New York; Rep. Second Dist., 1842, p. 394, fig. 2.—Hall, Pal. New York, I, 1847, p. 123, pl. 32, fig. 10.—Billings, Canadian Nat. Geol., I, 1856, p. 205, fig. 5 —Rogers, Geol. Pennsylvania, II, Pt. II,

Dinorthis pectinella (Emmons)—Continued.

1858, p. 818, fig. 602.—Billings, Geol. Canada, 1863, p. 165, fig. 147.—Hall, Second Ann Rep. New York State Geol., 1883, pl. 34, figs. 39, 40.

Orthis pectinella var. semiovalis Hall, Pal. New York, I, 1847, p. 124, pl. 32, fig. 11.—Miller, N. American Geol. Pal., 1889, p. 359.

Orthis charlottæ N. H. Winchell, Eighth Rep. Geol. Nat. Hist. Survey Minnesota, 1880, p. 67.

Dinorthis pectinella Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 195, 222, 228, pl. 5, figs. 27–33

Orthis (Dinorthis) pectinella Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 424, pl. 32, figs. 31–34.—Whiteaves, Pal. Foss., III, Pt. III, 1897, p. 175.

Loc. Middleville, Trenton Falls, etc., New York; Pennsylvania; Mercer County, Kentucky; Ontario, Canada; Decorah, Iowa; St. Paul, Minneapolis, and Cannon Falls, Minnesota; Lake Winnipeg, Canada.

Dinorthis pectinella sweeneyi N. H. Winchell. Trenton (Ord.).

Orthis sweeneyi N. H. Winchell, Ninth Rep. Geol. Nat. Hist. Survey Minnesota, 1881, p. 117.

Dinorthis sweeneyi Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 196, 222, 228, pl. 5, figs. 34–36.

Orthis (Dinorthis) pectinella var. sweeneyi Winchell and Schuchert, Minnesota Geol. Survey, III, 1893. p. 426, pl. 32, figs. 35–38.

Loc. St. Paul, Cannon Falls, etc., Minnesota; Decorah and McGregor, Iowa.

Dinorthis platys (Billings). Chazy (Ord.).

Orthis platys Billings, Canadian Nat. Geol., IV, 1859, p. 438, fig. 15;—Geol. Canada, 1863, p. 129, fig. 54.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 218.

Loc. Island of Montreal, Canada.

Dinorthis porcata (McCoy). Trenton and Lorraine (Ord.).

Orthis porcata McCoy, Silurian Foss. of Ireland, 1846, p. 32, pl. 3, fig. 14.—Billings, Pal. Fossils, I, 1862, p. 135, fig. 111;—Geol. Canada, 1863, p. 312, fig. 319.

Orthis anticostiensis Shaler, Fossil Brachiopoda of the Ohio Valley, 1887, p. 19, pl. 6.

Plæsiomys porcata Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 197, 222, pl. 5A, figs. 20, 21.

Loc. Ireland; Ottawa, Canada; Anticosti.

Dinorthis proavita Winchell and Schuchert. Lorraine (Ord.).

Orthis proavita Winchell and Schuchert, American Geol., IX, April 1, 1892, p. 290.

Orthis petræ Sardeson, Bull. Minnesota Acad. Nat. Sci., III, April 9, 1892, p. 332, pl. 5, figs. 18–21.

Orthis (Dinorthis) proavita Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 431, pl. 32, figs. 51–57.—? Whiteaves, Pal. Foss., III, Pt. III, 1897, p. 176.

Loc. Spring Valley, Minnesota; Wilmington, Illinois; Lake Winnipeg, Canada.

Dinorthis retrorsa (Salter). Trenton and Lorraine (Ord.).

Orthis retrorsa Salter, Mem. Geol. Survey Great Britain, II, 1858, p. 373, pl. 27, figs. 3, 4.—Billings, Pal. Fossils, I, 1862, p. 136, figs. 112, 113.—Meek, Pal. Ohio, I, 1873, p. 92, pl. 11, fig. 7.—Miller, Cincinnati Quart. Jour. Sci., II, 1875, p. 37.

Orthis carleyi Hall, Thirteenth Rep. New York State Cab. Nat. Hist., 1860, p. 120, fig. in text;—Second Ann. Rep. New York State Geol., 1883, pl. 34, figs. 28, 29.

Orthis kennicotti McChesney, New Pal. Fossils, 1861, p. 78.

Dinorthis retrorsa (Salter)—Continued.

Plæsiomys retrorsa Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 197, 222, pl. 5A, figs. 14–16.

Loc. England; Oxford, etc., Ohio; Ottawa, Canada.

Dinorthis subquadrata (Hall). Lorraine (Ord.).

Orthis subquadrata Hall, Pal. New York, I, 1847, p. 126, pl. 32A, fig. 1;—Geol. Wisconsin, I, 1862, p. 54, figs. 1, 2.—Meek, Pal. Ohio, I, 1873, p. 94, pl. 9, fig. 2.—Miller, Cincinnati Quart. Jour. Sci., II, 1875, p. 38.—White, Second Ann. Rep. Indiana Bureau of Statistics and Geol., 1880, p. 484, pl. 1, figs. 3–5;—Tenth Rep. State Geol. Indiana, 1881, p. 116, pl. 1, figs. 3–5.—Shaler, Foss. Brachiopoda of the Ohio Valley, 1887, p. 22, pl. 7.—Keyes, Geol. Survey Missouri, V, 1895, p. 60.

?Orthis subquadrata Billings, Geol. Canada, 1863, p. 165, fig. 146.

Plæsiomys subquadrata Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 194, 196, 222, pl. 5A, figs. 17-19.

Orthis (Dinorthis) subquadrata Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 428, pl. 32, figs. 46–50.—Whiteaves, Pal. Foss., III, Pt. III, 1897, p. 176.

Loc. Ohio Valley; Spring Valley, Minnesota; Wilmington, Illinois; Warren and Jefferson counties, Missouri; Lattners, Iowa; Iron Ridge, Wisconsin; Lake Winnipeg, Canada; Anticosti.

Discina of authors (non Lamarck)=Orbiculoidea.

Discina acadica Hartt=Parmophorella acadica, a gastropod.

Discina alleghania Hall=Orbiculoidea alleghania.

Discina ampla Hall=Orbiculoidea ampla.

Discina capax White=Orbiculoidea capax.

Discina capuliformis McChesney=Orbiculoidea capuliformis.

Discina circe Billings=Orbiculoidea lamellosa.

Discina clara Spencer=Schizotreta tenuilamellata.

Discina concordensis Sardeson=Schizotreta pelopea.

Discina connata Walcott=Lingulodiscina connata.

Discina conradi Hall=Orbiculoidea conradi.

Discina convexa Shumard=Orbiculoidea convexa.

Discina discus Hall=Orbiculoidea discus.

Discina doria Hall=Orbiculoidea doria.

Discina elmira Hall=Orbiculoidea elmira.

Discina forbesi Nicholson=Schizotreta tenuilamellata.

Discina gallaheri Winchell=Orbiculoidea gallaheri.

Discina grandis Vanuxem=Romerella grandis.

Discina grandis Hall=Orbiculoidea ampla.

Discina humilis Hall=Orbiculoidea humilis.

?Discina inutilis Hall. Upper Cambrian.

Discina inutilis Hall, Sixteenth Rep. New York State Cab. Nat. Hist., 1863, p. 130, pl. 6, fig. 11;—Trans. Albany Institute, V, 1867, p. 108.

Loc. Mazomanie, Wisconsin.

Obs. Undeterminable.

Discina illinoisensis Miller and Gurley=Orbiculoidea illinoisensis.

Discina jervensis Barret=Orbiculoidea jervisensis.

Discina keokuk Gurley=Orbiculoidea keokuk.
Discina lodensis Hall=Orbiculoidea lodiensis.
Discina magnifica Herrick=Orbiculoidea magnifica.
Discina manhattensis Meek and Hayden=Orbiculoidea manhattanensis.
Discina marginalis Whitfield=Orbiculoidea marginalis.
Discina media Hall=Orbiculoidea lodiensis media.
Discina meekana Whitfield=Orbiculoidea missouriensis.
Discina microscopica Shumard=Acrotreta microscopica.
Discina minuta Hall=Orbiculoidea minuta.
Discina missouriensis Shumard=Orbiculoidea missouriensis.
Discina munda Miller and Gurley=Orbiculoidea munda.
Discina neglecta Hall=Orbiculoidea neglecta.
Discina newberryi Hall=Lingulodiscina newberryi.
Discina nitida Meek and Worthen=Orbiculoidea missouriensis.
Discina nitida=Orbiculoidea nitida.
Discina patellaris Winchell=Orbiculoidea patellaris.
Discina pelopea Billings=Schizotreta pelopea.

Discina(?) pileolus Whiteaves. ? Lower Cretaceous.

Discina pileolus Whiteaves, Cont. Canadian Pal., I, 1889, p. 159, pl. 21, fig. 3.
Loc. Rink Rapids on Lewis River, British America.
Obs. "Professor Hyatt thinks that the fossils from this locality are Jurassic" (Stanton).

Discina pleurites Meek=Lingulodiscina pleurites.
Discina randalli Hall=Orbiculoidea randalli.
Discina saffordi Winchell=Orbiculoidea saffordi.
Discina sampsoni Miller=Orbiculoidea sampsoni.

Discina(?) semipolita Whiteaves. Cretaceous.

Discina semipolita Whiteaves, Mesozoic Fossils, I, Geol. Survey Canada, 1884, p. 252, pl. 33, fig. 9.
Loc. Queen Charlotte Island.

Discina seneca Hall=Orbiculoidea senecca.
Discina solitaria Ringueberg=Schizotreta tenuilamellata.

?Discina sublamellosa Ulrich. Lorraine (Ord.).

Discina sublamellosa Ulrich, Jour. Cincinnati, Soc. Nat. Hist., I, 1878, p. 97, pl. 4, fig. 11.—Miller, N. American Geol. Pal., 1889, p. 344.
Loc. Covington, Kentucky.
Obs. Probably not a brachiopod.

Discina subtrigonalis McChesney=Orbiculoidea subtrigonalis.
Discina tenuilamellata var. subplana Hall=Orbiculoidea subplana.
Discina tenuilineata Meek and Hayden=Orbiculoidea tenuilineata.
Discina tenuistriata Ulrich=Orbiculoidea tenuistriata.
Discina trigonalis McChesney=Orbiculoidea subtrigonalis.
Discina truncata Hall=Schizobolus concentricus.
Discina truncata Emmons=Orbiculoidea lamellosa.
Discina tullia Hall=Orbiculoidea tullia.
Discina utahensis Meek=Orbiculoidea utahensis.

Discina(?) vancouverensis Whiteaves. Cretaceous.

Discina vancouverensis Whiteaves, Mesozoic Fossils, I, Geol. Survey Canada, 1879, p. 177, pl. 20, fig. 6.

Loc. Admiralty Island.

Discina vanuxemi Hall=Orbiculoidea vanuxemi.

Discina varsoviensis Worthen=Orbiculoidea varsaviensis.

Discinella Hall=Operculum of Pteropod.

DISCINISCA Dall. Genotype Discina lamellosa Broderip.

Discinisca Dall, Bull. Mus. Comp. Zoology, III, 1871, p. 37.

Discinisca lugubris (Conrad). Miocene and Pliocene.

Capulus lugubris Conrad, Jour. Acad. Nat. Sci. Philadelphia, VII, 1834, p. 143.

Orbicula lugubris Conrad, Fossils Medial Tertiary For. U. S., 1845, p. 75, pl. 43, fig. 2.—Tuomey and Holmes, Foss. South Carolina, 1855, p. 17, pl. 5, fig. 1.—Dall, Republication of Conrad's Foss. Medial Tert. For. U. S., 1893, p. 101, pl. 43, fig. 2.

Discina lugubris, Whitfield, Mon. U. S. Geol. Survey, XXIV, 1894, p. 23, pl. 1, figs. 1–3.

Loc. St. Marys County, Maryland; Petersburg, Virginia; Peedee River, South Carolina; Atlantic City, Shiloh, and Bridgeton, New Jersey.

Obs. Referred to Discinisca on authority of Dr. W. H. Dall.

Discinisca multilineata (Conrad). Miocene.

Orbicula multilineata Conrad, Fossils Medial Tertiary For. U. S., 1845, p. 75, pl. 43, fig. 3.—Tuomey and Holmes, Foss. South Carolina, 1855, p. 18, pl. 5, fig. 2.—Dall, Republication of Conrad's Foss. Medial Tert. For. U. S., 1893, p. 101, pl. 43, fig. 3.

Loc. City Point, Virginia; Pedee River, South Carolina.

Obs. Probably a less worn variety of D. lugubris (Dall).

DISCINOPSIS Matthew. Genotype Acrotreta? gulielmi Matthew.

Discinopsis (Matthew MS.) Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 105, 167;—Eleventh Ann. Rep. New York State Geologist, 1894, p. 250.

Discinopsis gulielmi Matthew. Middle Cambrian.

Acrotreta? gulielmi Matthew, Trans. Royal Soc. Canada, 1886, p. 37, pl. 5, fig. 14.

Discinopsis gulielmi Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 105, pl. 3, figs. 20–24.

Loc. Portland, New Brunswick.

EATONIA Hall. Genotype Atrypa peculiaris Conrad.

Eatonia Hall, Tenth Rep. New York State Cab. Nat. Hist., 1857, p. 90;—Twelfth Rep. Ibidem, 1859, p. 35;—Pal. New York, III, 1859, p. 432.—Billings, Proc. Portland Soc. Nat. Hist., 1863, p. 111.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 205;—Thirteenth Ann. Rep. New York State Geologist, 1895, p. 829.

Eatonia coulteri Miller and Gurley. Oriskany (Dev.).

Eatonia coulteri Miller and Gurley, Bull. Illinois State Mus. Nat. Hist., 3, 1893, p. 72, pl. 7, figs. 8–11.

Loc. Jackson County, Illinois.

Eatonia eminens Hall. Lower Helderberg (Dev.).

Eatonia eminens Hall, Tenth Rep. New York State Cab. Nat. Hist., 1857, p. 92;—Pal. New York, III, 1859, p. 242, pl. 37, fig. 2.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 206.

Loc. Decatur County, Tennessee.

Eatonia medialis (Vanuxem). Lower Helderberg (Dev.).

Atrypa medialis Vanuxem, Geol. New York; Rep. Third Dist., 1842, p. 120, fig. 4.

Eatonia medialis Hall, Tenth Rep. New York State Cab. Nat. Hist., 1857, p. 90, figs. 1-7;—Pal. New York, III, 1859, p. 241, pl. 37, fig. 1.—Billings, Proc. Portland Soc. Nat. Hist., 1863, p. 111, pl. 3, fig. 7.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 206, pl. 61, figs. 29-35.

Loc. Scholarie, Carlisle, Catskill, etc., New York; Square Lake, Maine.

Eatonia peculiaris (Conrad). Lower Helderberg and Oriskany (Dev.).

Atrypa peculiaris Conrad, Fifth Ann. Rep. Geol. Survey New York, 1841, p. 56.—Vanuxem, Geol. New York; Rep. Third Dist., 1842, p. 123, fig. 3.—Hall, Ibidem, Rep. Fourth Dist, 1843, p. 148, fig. 3.—Rogers, Geol. Pennsylvania, II, Pt. II, 1858, p. 825, fig. 640.

Atrypa? nustella Castelnau, Essai Syst. Sil. l'Amérique Septentrionale, 1843, p. 39, pl. 14, fig. 3.

Eatonia peculiaris Hall, Twelfth Rep. New York State Cab. Nat. Hist., 1859, p. 37, figs. 1-7;—Pal. New York, III, 1859, p. 244, pl. 38, figs. 21-26; pl. 51, fig. 2; p. 436, pl. 101, fig. 2; pl. 101A, fig. 1;—Fifteenth Rep. New York State Cab. Nat. Hist., 1862, pl. 11.—Billings, Geol. Canada, 1863, p. 957, fig. 450.—Meek and Worthen, Geol. Survey Illinois, III, 1868, p. 395, pl. 8, fig. 2.—Billings, Pal. Fossils, II, 1874, p. 40, pl. 3A, fig. 2.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 206, pl. 61, figs. 17-26.

Eatonia peculiaris? Keyes, Geol. Survey Missouri, V, 1895, p. 104.

Loc. Schoharie, etc., New York; Pennsylvania; Cumberland, Maryland; Jackson and Perry counties, Missouri; Gaspé.

Eatonia pumila Hall. Oriskany (Dev.).

Eatonia pumila Hall, Pal. New York, III, 1859, p. 437, pl. 101, fig. 1.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 206.

Loc. Albany County, New York.

Eatonia singularis (Vanuxem). Lower Helderberg (Dev.).

Atrypa singularis Vanuxem, Geol. New York; Rep. Third Dist., 1842, p. 120, fig 3.

Eatonia singularis Hall, Pal. New York, III, 1859, p. 242, pl. 38, figs. 14-20.—Hall and Clarke, Ibidem, VIII, Pt. II, 1893, p. 206, pl. 61, figs. 13-16.

Loc. Scholarie, etc., New York.

Eatonia sinuata Hall. Oriskany (Dev.).

Eatonia sinuata Hall, Tenth Rep. New York State Cab. Nat. Hist., 1857, p. 91;—Pal. New York, III, 1859, p. 438, pl. 101A, figs. 3-6.—Hall and Clarke, Ibidem, VIII, Pt. II, 1893, p. 206, pl. 61, figs. 36-38.

Loc. Cumberland, Maryland.

Eatonia(?) variabilis Whiteaves. Hamilton (Dev.).

Eatonia variabilis Whiteaves, Cont. to Canadian Pal., I, 1891, p. 233, pl. 29, figs. 6-9.

Loc. Hay River, Canada.

Eatonia whitfieldi Hall. Oriskany (Dev.).

Eatonia whitfieldi Hall, Pal. New York, III, 1859, p. 437, pl. 101A, fig. 2.—Hall and Clarke, Ibidem, VIII, Pt. II, 1893, p. 206, pl. 61, figs. 27, 28.

Loc. Cumberland, Maryland.

EICHWALDIA Billings. Genotype Eichwaldia subtrigonalis Billings.

Eichwaldia Billings, Geol. Survey Canada; Rep. Progress for 1857, 1858, p. 190;—Canadian Nat. Geol., III, 1858, p. 442.

Eichwaldia of other authors=Dictyonella.

Eichwaldia subtrigonalis Billings. Trenton (Ord.).

Eichwaldia subtrigonalis Billings, Geol. Survey Canada; Rep. Progress for 1857, 1858, p. 192, fig. 24;—Canadian Nat. Geol., III, 1858, p. 443, fig. 24;—Geol. Canada, 1863, p. 142, fig. 76.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 310, figs. 241, 242; pl. 83, figs. 1-4.

Loc. Pauquette Rapids, Canada.

ELKANIA Ford. Genotype Obolella desiderata Billings.

Billingsia Ford (non de Koninck, 1876), American Jour. Sci., 3d ser., XXXI, 1885, p. 466.

Elkania Ford, American Jour. Sci., 3d ser., XXXII, 1886, p. 325.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 75, 165;—Eleventh Ann. Rep. New York State Geologist, 1894, p. 241.

Elkania ambigua (Walcott). Pogonip (base of Ord.).

Obolella? ambigua Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 67, pl. 1, fig. 2.

Elkania ambigua Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 78.

Loc. Eureka district, Nevada.

Elkania desiderata (Billings). Upper Cambrian.

Obolella desiderata Billings, Pal. Fossils, I, 1862, p. 69, fig. 62 on p. 68.

Obolella? desiderata Walcott, Bull. U. S. Geol. Survey, 30, 1886, p. 111.

Billingsia desiderata Ford, American Jour. Sci., 3d ser., XXXI, 1886, p. 466, figs. 1, 2.

Elkania desiderata Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 77, pl. 3, figs. 15–19.

Loc. Point Levis, Canada.

ENTELETES Fischer de Waldheim. Genotype Orthis lamarcki Fisch.

Enteletes Fischer de Waldheim, Oryct. Gouv. Moscou, 1830, p. 193, tab. 26, figs. 6, 7.—Waagen, Palæontologica Indica, Ser. XIII, I, 1884, p. 550.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 185, 214;—Eleventh Ann. Rep. New York State Geologist, 1894, p. 272.

Syntrielasma Meek and Worthen, Proc. Acad. Nat. Sci. Philadelphia, 1865, p. 277;—Geol. Survey Illinois, II, 1866, p. 321, fig. 36.

Enteletes andii (d'Orbigny). Upper Carboniferous.

Terebratula andii d'Orbigny, Voyage dans l'Amérique Méridionale, Pal., 1842, p. 45, pl. 3, figs. 14, 15.

Orthis andii Salter, Quart. Jour. Geol. Soc. London, XVII, 1861, p. 64, pl. 4, fig. 3.

Syntrielasma andii Derby, Bull. Cornell Univ., I, 1874, p. 62.

Rhynchonella andii Gabb, Jour. Acad. Nat. Sci. Philadelphia, 2d ser., VIII, 1881, p. 302.

Enteletes andii Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 217.

Loc. Yarbichambi and Lake Titicaca, Bolivia; Santa Cruz.

Enteletes gaudryi (d'Orbigny). Upper Carboniferous.

Terebratula gaudryi d'Orbigny, Voyage dans l'Amérique Méridionale, Pal., 1842, p. 45.

Terebratula antissiensis d'Orbigny, Ibidem, 1842, pl. 3, fig. 16 (non pl. 2).

Syntrielasma gaudryi Derby, Bull. Cornell Univ., I, 1874, p. 62.

Enteletes gaudryi Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 217.

Loc. Yarbichambi, Bolivia.

Enteletes hemiplicata Hall. Upper Carboniferous.

Spirifer hemiplicata Hall, Stansbury's Exped. Great Salt Lake, 1852, p. 409, pl. 4, fig. 3.

Enteletes hemiplicata Hall—Continued.

Rhynchonella angulata Geinitz (non Linné), Carbon u. Dyas Nebraska, 1866, p. 37, pl. 3, figs. 1–4.

Syntrielasma hemiplicata Meek and Worthen, Geol. Survey Illinois, II, 1866, p. 323, fig. 36; p. 324, fig. 37.—Meek, Final Rep. U. S. Geol. Survey Nebraska, 1872, p. 177, pl. 6, fig. 1; pl. 8, fig. 12.—Meek and Worthen, Geol. Survey Illinois, V, 1873, p. 571, pl. 26, fig. 20.—Kayser, Richthofens China, IV, 1883, p. 179, pl. 24, figs. 2, 3.—White, Thirteenth Rep. State Geol. Indiana, 1884, p. 131, pl. 26, figs. 15–18.—Keyes, Geol. Survey Missouri, V, p. 76, pl. 39, fig. 8.

Camerophoria giffordi Worthen, Bull. Illinois State Mus., 1, 1882, p. 39;—Geol. Survey Illinois, VII, 1883, p. 318, figs. a–c.

Enteletes hemiplicata Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 215, 226, pl. 7A, figs. 44–52.

Loc. Weston, Platte County, Missouri; Vandalia and Alta, Illinois; Stennett, Iowa; Kansas City, Missouri; Nebraska City, Nebraska; Lo Ping, China.

EUMETRIA Hall.

Genotype Retzia verneuiliana Hall=Terebratula marcyi Shumard.

Eumetria Hall, Sixteenth Rep. New York State Cab. Nat. Hist., 1863, p. 59.—Waagen, Palæontologica Indica, Ser. XIII, I, 1883, p. 487.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 115, figs. 104, 105;—Thirteenth Ann. Rep. New York State Geol., 1895, p. 795.

Eumetria(?) altirostris (White). Kinderhook (L. Carb.).

Retzia (Acambona?) altirostris White, Proc. Boston Soc. Nat. Hist., IX, 1862, p. 28.

Loc. Burlington, Iowa.

Eumetria marcyi (Shumard). St. Louis and Kaskaskia (L. Carb.).

Terebratula serpentina? Owen (non de Koninck), Geol. Survey Wisconsin, Iowa, Minnesota, 1852, pl. 3A, fig. 13 (see specimens in U. S. Nat. Mus., Cat. Invert. Foss., 17955).

Terebratula marcyi Shumard, Marcy's Rep. U. S. Expl. Red River of Louisiana, 1854, p. 177, pl. 1, fig. 4.

Retzia verneuiliana Hall, Geol. Survey Iowa, I, Pt. II, 1858, p. 657, pl. 23, fig. 1;—Trans. Albany Institute, IV, 1858, p. 9.

Retzia vera Hall, Geol. Survey Iowa, I, Pt. II, 1858, p. 704, pl. 27, fig. 3.

Eumetria vera Hall, Sixteenth Rep. New York State Cab. Nat. Hist., 1863, p. 55, figs. 1–3, and p. 59.

Eumetria verneuiliana Hall, Ibidem, 1863, p. 55, fig. 2.—Whitfield, Bull. American Mus. Nat. Hist., 1882, p. 50, pl. 6, figs. 28–30.—Hall, Twelfth Rep. State Geol. Indiana, 1883, p. 335, pl. 29, figs. 28–30.

Retzia radialis Walcott (non Phillips), Mon. U. S. Geol. Survey, VIII, 1884, p. 220, pl. 7, figs. 5, 5a (5b?).

Retzia marcyi Miller, N. American Geol. Pal., 1889, p. 366.

Eumetria verneuiliana and vera Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 117, figs. 104, 105, pl. 50, figs. 13–26, 34, 37; pl. 83, figs. 26, 27.

Loc. Washington and Crawford counties, Arkansas; Floyd County and elsewhere in Indiana; Alton, Illinois; Greene County, Missouri; Iowa; Cumberland Mountain, Tennessee.

Obs. Hall and Clarke (1893), in treating of the American species of Eumetria (E. vera and var. costata, and E. verneuiliana), say they "are, perhaps, all representatives of the same species." The writer regards them as one species, varying in different localities in size and number of striations. Owen was the first to observe this form and identified it provisionally with T. serpentina de Koninck. Shumard, however, believed it to be distinct from that species, and gave the name T. marcyi four years prior to that of Hall.

Eumetria marcyi costata Hall. Kaskaskia (L. Carb.).

Retzia vera var. costata Hall, Geol. Survey Iowa, I, Pt. II, 1858, p. 704, pl. 27, fig. 3.

Eumetria vera var. costata Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 51, figs. 27–33.

Loc. Chester, Illinois; Crittenden County, Kentucky.

Eumetria vera Hall = E. marcyi.

Eumetria verneuiliana Hall = E. marcyi.

Eumetria woosteri (White). ? Upper Carboniferous.

Retzia woosteri White, Bull. U. S. Geol. Survey Terr., V, 1879, p. 215;—Twelfth Ann. Rep. U. S. Geol. Survey Terr., 1883, p. 134, pl. 34, fig. 8.

Loc. Near Greeley, Colorado.

Obs. Closely related with E. marcyi of the Lower Carboniferous.

EUNELLA Hall and Clarke. Genotype Terebratula sullivanti Hall.

Eunella Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 290;—Thirteenth Ann. Rep. New York State Geol., 1895, p. 861.

Eunella harmonia Hall. Corniferous (Dev.).

Terebratula harmonia Hall, Pal. New York, IV, 1867, p. 388, pl. 60, figs. 11–16.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 154, pl. 17, figs. 1–4.

Eunella harmonia Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 290, pl. 80, figs. 33–35.

Loc. Falls of Ohio; Ontario, Canada.

Eunella lincklæni Hall. Marcellus and Hamilton (Dev.).

Terebratula lincklæni Hall, Thirteenth Rep. New York State Cab. Nat. Hist., 1860, p. 88;—Pal. New York, IV, 1867, corrigenda.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 155, pl. 17, figs. 22–24.

Cryptonella lincklæni Hall, Fourteenth Rep. New York State Cab. Nat. Hist., 1861, p. 101;—Sixteenth Rep. Ibidem, 1863, p. 44.

Cryptonella? lincklæni Hall, Pal. New York, IV, 1867, p. 397, pl. 60, figs. 49–65.

Terebratula lincklæni var. Hall, Ibidem, 1867, p. 418, pl. 60, figs. 32–37.

Eunella lincklæni Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 290, pl. 80, figs. 28–32.

Loc. Clarke County, Indiana; Hamilton and Canandaigua Lake, New York; Thunder Bay, Michigan.

Eunella simulator Hall. Hamilton (Dev.).

Terebratula simulator Hall, Pal. New York, IV, 1867, p. 391, pl. 60, figs. 69, 70.

Eunella simulator Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 290, pl. 80, fig. 27.

Loc. Thedford, Ontario.

Eunella sullivanti Hall. Corniferous (Dev.).

Terebratula sullivanti Hall, Pal. New York, IV, 1867, p. 387, pl. 60, figs. 5–10, 68.—Whiteaves, Cont. Canadian Pal., I, 1892, p. 291, pl. 37, figs. 9, 10.

Eunella sullivanti Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 290, fig. 210, pl. 80, figs. 23–26.

Loc. Columbus and Sandusky, Ohio; near Cayuga, Ontario, and Lakes Manitoba, and Winnipegosis, Canada.

GLASSIA Davidson. Genotype Atrypa obovata Sowerby.

Glassia Davidson, Geol. Mag., n. ser., VIII, 1881, p. 11;—Sup. British Devonian and Silurian Brach., Pal. Soc., 1882, p. 38.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 152, figs. 142–145;—Thirteenth Ann. Rep. New York State Geologist, 1895, p. 811.

Glassia romingeri Hall and Clarke. Trenton (Ord.).

Glassia romingeri Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 153, pl. 83, figs. 32–35.

Loc. Drift near Ann Arbor, Michigan.

Glassia schucherti Ulrich=Catazyga headi.

GLOSSINA Phillips. Genotype Lingula attenuata Sowerby.

Glossina Phillips, Mem. Geol. Survey Great Britain, II, Pt. II, 1848, p. 370.—Dall, Bull. U. S. Nat. Mus., 8, 1877, p. 29.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 15, 164;—Eleventh Ann. Rep. New York State Geologist, 1894, p. 230.

Glossina acuminata Hall and Clarke=Lingulepis acuminata.

Glossina crassa (Hall). Trenton (Ord.).

Lingula crassa Hall, Pal. New York, I, 1847, p. 98, pl. 30, fig. 8.

Loc. Middleville and Lake Champlain, New York.

Glossina cyane (Billings). Calciferous (Ord.).

Lingula cyane Billings, Pal. Fossils, I, 1865, p. 216, fig. 200.

Loc. Near Portland Creek, Newfoundland.

Glossina deflecta Winchell and Schuchert. Trenton and Lorraine (Ord.).

Lingula (Glossina) deflecta Winchell and Schuchert, American Geol., IX, 1892, p. 284;—Minnesota Geol. Survey, III, 1893, p. 348, pl. 29, figs. 15–18.

Loc. Near Fountain and Spring Valley, Minnesota.

Glossina dubia (d'Orbigny). Ordovician.

Lingula dubia d'Orbigny, Voyage dans l'Amérique Méridionale, 1842, p. 29, pl. 2, fig. 7.

Loc. Tacopaya, Bolivia.

Glossina flabellula Hall and Clarke. Waverly (L. Carb.).

Lingula (Glossina) flabellula Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 15, 172, pl. 1, figs. 33, 31.

Loc. Sciotoville, Ohio.

Glossina hurlbuti N. H. Winchell. Trenton (Ord.).

Lingula hurlbuti N. H. Winchell, Eighth Ann. Rep. Geol. Nat. Hist., Survey Minnesota, 1880, p. 62.

Lingula (Glossina) hurlbuti Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 347, pl. 29, figs. 13, 14.

Loc. Mantorville and near Spring Valley, Minnesota.

Glossina leana (Hall). Hamilton (Dev.).

Lingula leana Hall, Sixteenth Rep. New York State Cab. Nat. Hist., 1863, p. 20;—Pal. New York, IV, 1867, p. 9, pl. 2, fig. 12.—Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 106, pl. 13, fig. 2.

Loc. Bristol, New York; Lone Mountain, Nevada.

Glossina nebraskaensis (Meek). Upper Carboniferous.

Lingula scotica var. nebraskensis Meek, Final Rep. U. S. Geol. Survey Nebraska, 1872, p. 158, pl. 8, fig. 3.

Lingula nebraskensis Miller, N. American Geol. Pal., 1889, p. 350.

Loc. Nebraska City, Nebraska.

Glossina perovata (Hall). Clinton (Sil.).

Lingula perovata Hall, Pal. New York, II, 1852, p. 55, pl. 20, fig. 3.

Loc. Rochester, New York.

Glossina sedaliaensis (Miller). Chouteau (L. Carb.).

Lingula sedaliensis Miller, Eighteenth Ann. Rep. Geol. Survey Indiana, 1894, p. 308, pl. 9, fig. 2.

Loc. Sedalia, Missouri.

Obs. This species is probably the same as G. waverlyensis.

Glossina spatiosa (Hall). Lower Helderberg (Dev.).

Lingula spatiosa Hall, Pal. New York, III, 1859, p. 158, pl. 9, fig. 10.

Loc. Near Hudson, New York.

Glossina trentonensis (Conrad). Trenton and Utica (Ord.).

Lingula trentonensis Conrad, Jour. Acad. Nat. Sci. Philadelphia, VIII, 1842, p. 266, pl. 15, fig. 11.—Vanuxem, Geol. New York; Rep. Third Dist., 1842, p. 48.

Lingula attenuata? Hall (non Sowerby), Pal. New York, I, 1847, p. 94, pl. 30, fig. 1.

Lingula daphne Billings, Pal. Fossils, I, 1862, p. 50.

?Lingula attenuata A. Ulrich, N. Yahrb. f. Mineral, Beilageband, VIII, 1892, p. 7, pl. 1, fig. 3.

Loc. Glens Falls, Trenton Falls, Middleville, New York; Wisconsin; Montreal and Ottawa, Canada; ?near Vacas, Bolivia.

Glossina triangulata (Nettelroth). Hamilton (Dev.).

Lingula triangulata Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 34, pl. 26, fig. 1.

Loc. Falls of Ohio.

Glossina waverlyensis (Herrick). Waverly (L. Carb.).

Lingula scotica?? Meek, Pal. Ohio, II, 1875, p. 276, pl. 14, fig. 9.

Lingula waverlyensis Herrick, Bull. Denison Univ., IV, 1888, pp. 12, 18, pl. 3, fig. 1.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 9, pl. 4K, fig. 7.

Lingula (scotica var.) waverlyensis Herrick, Geol. Ohio, VII, 1895, pl. 22, fig. 1.

Loc. Berea and Newark, Ohio; Oil City, Pennsylvania.

Obs. See G. sedaliaensis (Miller).

Goniocœlia Hall=Pentagonia.

Goniocœlia uniangulata Hall=Pentagonia unisulcata.

Gotlandia Dall=Trimerella.

Gypidia Dalman=Conchidium.

Gypidia unguiformis Ulrich=Conchidium unguiformis.

GYPIDULA Hall. Genotype Pentamerus occidentalis Hall.

Gypidula Hall, Twentieth Rep. New York State Cab. Nat. Hist., 1867, p. 163;—Pal. New York, IV, 1867, pp. 373, 380.—Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 161.

Sieberella Œhlert, Fischer's Manuel de Conchyliologie, 1887, p. 1311.

Gypidula and Sieberella Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 245;—Thirteenth Ann. Rep. New York State Geol., 1895, pp. 845, 846.

Gypidula comis (Owen). Middle Devonian.

Atrypa comis Owen, Geol. Rep. Wisconsin, Iowa, Minnesota, 1852, p. 583, pl. 3A, fig. 4 (see specimens in U. S. Nat. Mus., Cat. Invert. Foss., 17928).

Pentamerus (n. sp.?) Owen, Ibidem, 1852, pl. 3A, fig. 11 (Ibidem, Cat., 17929).

Pentamerus occidentalis Hall, Geol. Survey Iowa, I, Pt. II, 1858, p. 514, pl. 6, fig. 2 (non Pentamerus occidentalis Hall, 1852).

Pentamerus galeatiformis Meek and Worthen, Geol. Survey, Illinois, II, 1866, p. 325.

Gypidula occidentalis Hall, Pal. New York, IV, 1867, p. 380, pl. 58A, figs. 1–8.

Gypidula comis (Owen)—Continued.

Pentamerus comis Meek and Worthen, Geol. Survey Illinois, III, 1868, p. 428, pl. 13, fig. 6.—Whiteaves, Cont. Canadian Pal., I, 1892, p. 290.

Pentamerus (Gypidula) comis Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 159, pl. 3, figs. 4, 7; pl. 14, fig. 15; pl. 15, fig. 5.

Gypidula comis Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 247, fig. 177; pl. 72, figs. 15–24.

Loc. Independence and Davenport, Iowa; Rock Island, Illinois; Eureka district, Nevada; lakes Manitoba and Winnipegosis, Canada.

Gypidula coppingeri (Etheridge). Silurian.

Pentamerus coppingeri Etheridge, Quart. Jour. Geol. Soc. London, XXXIV, 1878, p. 594, pl. 25, figs. 2, 3.

Loc. Offley Island, lat. 81° 16′.

Gypidula galeata (Dalman). Lower Helderberg and Middle Devonian.

Atrypa galeata Dalman, Kongl. Svenska, Vet.-Akad. Handl., för 1827, 1828, p. 46, pl. 5, fig. 4.—Troost, Sixth Geol. Rep. Tennessee, 1841, p. 15.—Vanuxem, Geol. New York; Rep. Third Dist., 1842, p. 117, fig. 1.—Castelnau, Essai Syst. Sil. l'Amérique Septentrionale, 1843, p. 39, pl. 14, fig. 4.

Pentamerus galeatus Hall, Tenth Rep. New York State Cab. Nat. Hist., 1857, p. 105, figs. 1–3.—Rogers, Geol. Pennsylvania, II, Pt. II, 1858, p. 825, fig. 646.—Hall, Pal. New York, III, 1859, p. 257, pl. 46, fig. 1; pl. 47, fig. 1.—Billings, Geol. Canada, 1863, p. 957, fig. 454.

Pentamerus galeatus var. Whiteaves, Cont. to Canadian Pal., I, 1891, p. 234.

Sieberella galeatus Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 246, fig. 175; pl. 72, figs. 7–13.

Loc. Europe; Albany and Schoharie counties, New York; Cumberland, Maryland; Pennsylvania; St. Blandine, New Brunswick; Mackenzie River, Canada.

Gypidula globulosa (Nettelroth). Niagara (Sil.).

Pentamerus globulosus Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 54.

Loc. Louisville, Kentucky.

Gypidula knotti (Nettelroth). Niagara (Sil.).

Pentamerus knotti Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 56, pl. 32, figs. 9–12.

Loc. Louisville, Kentucky.

Gypidula læviuscula Hall. Middle Devonian.

Gypidula læviuscula Hall, Pal. New York, IV, 1867, p. 381, pl. 58, figs. 22, 23.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 248, pl. 72, figs. 25, 26.

Loc. Waterloo, Iowa.

Gypidula lotis (Walcott). Upper Devonian.

Pentamerus lotis Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 161, pl. 3, fig. 9.

Gypidula lotis Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 248.

Loc. White Pine mining district, Nevada.

Gypidula munda Calvin. Middle Devonian.

Gypidula munda Calvin, Bull. U. S. Geol. Geogr. Survey Terr., IV, 1878, p. 730.

Gypidula mundula Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 248.

Loc. Independence, Iowa.

Gypidula nucleus (Hall and Whitfield). ? Clinton (Sil.).

Pentamerus galeatus Hall and Whitfield, Twenty-fourth Rep. New York State Cab. Nat. Hist., 1872, pp. 197, 200a.

Pentamerus nucleus Hall and Whitfield, Twenty-seventh Rep. New York State Cab. Nat. Hist., 1875, pl. 9, figs. 30–32.—Nettelroth, Kentucky Fossil Shells, *Mem.* Kentucky Geol. Survey, 1889, p. 59, pl. 27, figs. 25–27; pl. 33, figs. 27–33.

Gypidula nucleus (Hall and Whitfield)—Continued.

Sieberella nucleus Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 247, pl. 72, figs. 1-3.

Loc. Louisville, Kentucky.

Gypidula occidentalis Hall=G. comis.

Gypidula pseudogaleata (Hall). Lower Helderberg (Dev.).

Pentamerus pseudogaleatus Hall, Tenth Rep. New York State Cab. Nat. Hist., 1857, p. 106, figs. 1-6;—Pal. New York, III, 1859, p. 259, pl. 46, fig. 2.

Sieberella pseudogaleata Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 242, pl. 72, fig. 14.

Loc. Schoharie and Carlisle, New York.

Gypidula rœmeri (Hall and Clarke). Silurian.

Pentamerus galeatus Roemer (not Dalman), Sil. Fauna west. Tennessee, 1860, p. 73, pl. 5, fig. 14.

Sieberella rœmeri Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 247, pl. 72, fig. 6.

Loc. Decatur County, Tennessee.

Gypidula romingeri Hall and Clarke. Hamilton (Dev.).

Gypidula romingeri Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 248, pl. 72, figs. 27-33.

Loc. Alpena, Michigan.

Gypidula subglobosa (Meek and Worthen). Hamilton (Dev.).

Pentamerus subglobosus Meek and Worthen, Geol. Survey Illinois, III, 1868, p. 429, pl. 13, fig. 5.

Gypidula subglobosa Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 248.

Loc. Rock Island, Illinois.

Gypidula uniplicata (Nettelroth). Niagara (Sil.).

Pentamerus uniplicatus Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 63, pl. 33, figs. 25, 26.

Sieberella uniplicata Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 247.

Loc. Louisville, Kentucky.

HARTTINA Hall and Clarke. Genotype Centronella anna Hartt.

Harttina Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 292;—Thirteenth Ann. Rep. New York State Geologist, 1895, p. 862.

Harttina coutinhoana (Derby). Upper Carboniferous.

Waldheimia coutinhoana Derby, Bull. Cornell Univ., I, 1874, p. 3, pl. 3, fig. 22; pl. 8, fig. 6; pl. 9, figs. 1, 2.

Harttina coutinhoana Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 292.

Loc. Bomjardim, Brazil.

Harttina anna (Hartt). Upper Carboniferous.

Centronella anna Hartt, Dawson's Acadian Geol., 3d ed., 1878, p. 300, fig. 99.

Harttina anna Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 292, figs. 211, 212; pl. 79, figs. 37-39.

Loc. Windsor, Nova Scotia.

Hallina Winchell and Schuchert=Zygospira.

HEBERTELLA Hall and Clarke. Genotype Orthis sinuata Hall.

Group of Orthis occidentalis Hall, Bull. Geol. Soc. America, I, 1889, p. 20.

Hebertella Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 198, 222.—Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 432.—Hall and Clarke, Eleventh Ann. Rep. New York State Geologist, 1894, p. 266.

Hebertella battis (Billings). Calciferous (Ord.).

Orthis battis Billings, Pal. Fossils, I, 1865, p. 185.

Hebertella Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 222.

Loc. Point Levis, Canada.

Hebertella bellirugosa (Conrad). Trenton (Ord.).

Orthis bellarugosa Conrad, Proc. Acad. Nat. Sci. Philadelphia, I, 1843, p. 333.—Hall, Pal. New York, I, 1847, p. 118, pl. 32, fig. 3.

Hebertella bellarugosa Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 222.

Orthis (Hebertella?) bellarugosa Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 434, pl. 33, figs. 1–4.

Loc. Mineral Point, Janesville, Neenah, etc., Wisconsin; Minneapolis, St. Paul, Cannon Falls, etc., Minnesota; Decorah and McGregor, Iowa; Curdsville, Kentucky; Rutherford County, Tennessee.

Hebertella borealis (Billings). Chazy-Trenton (Ord.).

Orthis borealis Billings, Canadian Nat. Geol., IV, 1859, p. 436, fig. 14;—Geol. Canada, 1863, p. 129, fig. 56; p. 167, fig. 148.—Meek, Pal. Ohio, I, 1873, p. 101, pl. 8, fig. 4.—Miller, Cincinnati Quart. Jour. Sci., II, 1875, p. 28.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 36, pl. 34, figs. 14–20.

Hebertella borealis Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 222.

Orthis (Hebertella) borealis Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 433, fig. 33.

Loc. Caughnawaga, St. Genevieve, Isle Bizard, and Cornwall, Canada; Frankfort, Kentucky; Nashville, Tennessee; Cannon Falls, etc., Minnesota; Wisconsin (Whitfield).

Hebertella daytonensis (Foerste). Clinton (Sil.).

Orthis daytonensis Foerste, Bull. Denison Univ., I, 1885, p. 87, pl. 13, figs. 13, 20, 21.

Hebertella daytonensis Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 222.

Orthis (Hebertella) daytonensis Foerste, Geol. Ohio, VII, 1895, p. 575, pl. 25, figs. 13, 20, 21.

Loc. Dayton, Ohio.

Hebertella fausta (Foerste). Clinton (Sil.).

Orthis fausta Foerste, Bull. Denison Univ., I, 1885, p. 85, pl. 13, figs. 15, 16.

Hebertella fausta Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 222.

Orthis (Hebertella) fausta and var. squamosa Foerste, Geol. Ohio, VII, 1895, pp. 573, 574, pl. 25, figs. 15a–15d, 16a, 16b; pl. 37A, figs. 19a, 19b.

Loc. Dayton, Ohio.

Hebertella imperator (Billings). Chazy (Ord.).

Orthis imperator Billings, Canadian Nat. Geol., IV, 1859, p. 435, figs. 11–13;—Geol. Canada, 1863, p. 129, fig. 55.

Hebertella imperator Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 222.

Loc. Hawkesbury and Cornwall, Canada.

Hebertella insculpta Hall. Lorraine (Ord.).

Orthis insculpta Hall, Pal. New York, I, 1847, p. 125, pl. 32, fig. 12.—Billings, Geol. Canada, 1863, p. 167, fig. 150.—Meek, Pal. Ohio, I, 1873, p. 99, pl. 9, fig. 1.—Miller, Cincinnati Quart. Jour. Sci., II, 1875, p. 40.

Orthis bellarugosa Hall (non Conrad), Second Ann. Rep. New York State Geol., 1883, pl. 35, fig. 22.

Hebertella insculpta Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 222, pl. 5A, fig. 13.

Hebertella insculpta Hall—Continued.

Orthis (Hebertella) insculpta Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 435.

Loc. Oxford, etc., Ohio; Richmond, Indiana; Wilmington, Illinois; Iron Ridge, Wisconsin; Lattners, Iowa.

Hebertella lonensis (Walcott). Pogonip (Ord.).

Orthis lonensis Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 74, pl. 11, fig. 6.

Hebertella lonensis Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 222.

Loc. Eureka district, Nevada.

Hebertella maria (Billings). Lorraine (Ord.).

Orthis maria Billings, Pal. Fossils, I, 1862, p. 137, fig. 114.

Hebertella sinuata or maria? Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 222, pl. 5A, figs. 9, 10.

Loc. Anticosti; Colby, Kentucky.

Hebertella occidentalis Hall. Lorraine (Ord.).

Orthis occidentalis Hall, Pal. New York, I, 1847, p. 127, pl. 32A, fig. 2; pl. 32B, fig. 1;—Twelfth Rep. New York State Cab. Nat. Hist., 1859, p. 72.—Billings, Geol. Canada, 1863, p. 210, fig. 210.—Meek, Pal. Ohio, I, 1873, p. 96, pl. 9, fig. 3.—White, Wheeler's Expl. Survey west 100th Merid., IV, 1875, p. 70, pl. 4, fig. 11.—Miller, Cincinnati Quart. Jour. Sci., II, 1875, p. 34.—White, Second Ann. Rep. Indiana Bureau Statistics and Geol., 1880, p. 485, pl. 2, figs. 10–12;—Tenth Rep. State Geol. Indiana, 1881, p. 117, pl. 2, figs. 10–12.—Whitfield, Geol. Wisconsin, IV, 1882, p. 260, pl. 12, figs. 17, 18.—Hall, Second Ann. Rep. New York State Geol., 1883, pl. 34, figs. 31–34; pl. 35, figs. 16–21.

Orthis subjugata Hall, Pal. New York, I, 1847, p. 129, pl. 32C, fig. 1.

Orthis subjugata(?) Owen, Geol. Survey Wisconsin, Iowa, Minnesota, 1852, pl. 2B, figs. 4, 5 (see specimens in U. S. Nat. Mus., Cat. Invert. Foss., 17885).

Hebertella occidentalis Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 222, pl. 5A, figs. 11, 12.

Loc. Cincinnati, Oxford, etc., Ohio; Richmond, Indiana; Savanna, Illinois; Cape Girardeau, Missouri; Delafield, Wisconsin; Silver City, New Mexico.

Hebertella occidentalis sinuata Hall. Lorraine (Ord.).

Orthis sinuata Hall, Pal. New York, I, 1847, p. 128, pl. 32B, fig. 2.—Miller, Cincinnati Quart. Jour. Sci., II, 1875. p. 36.—Shaler, Fossil Brachiopoda Ohio Valley, 1887, pl. 8.

Orthis occidentalis var. sinuata Meek, Pal. Ohio, I, 1873, p. 98.

Hebertella sinuata Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 222, pl. 5A, figs. 1–8.

Loc. Cincinnati, Ohio.

Hebertella scovilli (Miller). Lorraine (Ord.).

Orthis scovilli Miller, Jour. Cincinnati Soc. Nat. Hist., V, 1882, p. 40, pl. 1, fig. 5.

Hebertella scovilli Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 222.

Loc. Lebanon, Ohio.

Hemipronites americanus Whitfield=Clitambonites diversus.

Hemipronites apicalis Whitfield=Polytœchia apicalis.

Hemipronites crassus McChesney=Derbya crassa.

Hemipronites crenistria White (non Meek or Phillips)=Derbya crassa.

Hemipronites crenistria Meek, and Herrick=Orthothetes crenistria.

Hemipronites propinquus Meek and Worthen=Orthothetes subplanus.

HEMITHYRIS d'Orbigny. Genotype Rhynchonella psittacea Gmel.

Hemithyris d'Orbigny, Ann. Sci. Nat., VIII, 1850, p. 246; XIII, 1850, p. 322.

Hemithyris psittacea (Chemnitz). Pliocene and Recent.

Anomia rostrum psittacea Chemnitz, Neues syst. Conch.-Cab., VIII, 1785, pl. 78, fig. 713.

Rhynchonella psittacea Davidson, Trans. Linnæan Soc. London, IV, 1887, p. 163, pl. 24, figs. 1-11.

Loc. Fossil. Gulf of St. Lawrence, Canada.

HETERORTHIS Hall and Clarke. Genotype Orthis clytie Hall.

Heterorthis Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 207, 223;—Eleventh Ann. Rep. New York State Geologist, 1894, p. 268.

Heterorthis clytie Hall. Trenton (Ord.).

Orthis clytie Hall, Fourteenth Rep New York State Cab. Nat. Hist., 1861, p. 90;—Fifteenth Rep., Ibidem, 1862, pl. 2, figs. 4, 5.—Miller, Cincinnati Quart. Jour. Sci., II, 1875, p. 34.—Hall and Whitfield, Pal. Ohio, II, 1875, p. 75, pl. 1, figs. 18, 19.

Heterorthis clytie Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 202, 223, pl. 5B, figs 20-24.

Loc. Frankfort and Paris, Kentucky.

HINDELLA Davidson. Genotype Athyris umbonata Billings.

Hindella Davidson, Suppl. British Sil. Brach., Pal. Soc., 1882, p. 130.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 63, figs. 46-51;—Thirteenth Ann. Rep. New York State Geologist, 1895, p. 769.

Hindella prinstana (Billings). Anticosti (Sil.).

Athyris prinstana Billings, Pal. Fossils, I, 1862, p. 145, fig. 122.

Meristella prinstana Miller, N. American Geol. Pal., 1889, p. 354.

Hindella prinstana Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 64, pl. 41, fig. 28; pl. 49, fig. 1.

Loc. Anticosti.

Hindella umbonata (Billings). Anticosti (Sil.).

Athyris umbonata Billings, Pal. Fossils, I, 1862, p. 144, fig. 121;—Geol. Canada, 1863, p. 317, fig. 331.

Hindella umbonata Davidson, Suppl. British Sil. Brach., Pal. Soc., 1882, p. 130, fig. in text.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 64, figs. 46-51; pl. 41, figs. 26, 27, 29, 30.

Meristella umbonata Foerste, Bull. Denison Univ., I, 1885, p. 88, pl. 13, fig. 2;—Geol. Ohio, VII, 1895, p. 590, pl. 25, fig. 2.

Loc. Anticosti; Dayton, Ohio (Foerste).

HIPPARIONYX Vanuxem.

Genotype Hipparionyx proximus Vanuxem.

Hipparionyx Vanuxem, Geol. New York; Rep. Third Dist., 1842, p. 124, fig. 4.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 257;—Eleventh Ann. Rep. New York State Geologist, 1894, p. 284.

Hipparionyx consimilaris Vanuxem=Atrypa reticularis.

Hipparionyx proximus Vanuxem. Oriskany (Dev.).

Hipparionyx proximus Vanuxem, Geol. New York; Rep. Third Dist., 1842, p. 124, fig. 29, No. 4.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 257, pl. 9, figs. 33-36; pl. 15A, figs. 9-11.

Atrypa unguiformis (Conrad) Hall, Geol. New York; Rep. Fourth Dist., 1843, p. 149, fig. 4.—Rogers, Geol. Pennsylvania, II, Pt. II, 1858, p. 826, fig. 651

Orthis conradi Castelnau, Essai Syst. Sil. l'Amérique Septentrionale, 1843, p. 37, pl. 15, fig. 4.

Orthis unguiformis Castelnau, Ibidem, 1843, p. 37, pl. 15, fig. 3.—Emmons, Manual Geol., 1860, p. 129, fig. 115.

Hipparionyx proximus Vanuxem—Continued.

Orthis hipparionyx Hall, Pal. New York, III, 1859, p. 407, pl. 89, figs. 1–4; pl. 90, figs. 1–7; pl. 91, figs. 4, 5; pl. 94, fig. 4.

Strophodonta intermedia Hall, Pal. New York, III, 1859, p. 482, pl. 95A, figs. 13, 14.

Streptorhynchus hipparionyx Hall, Second Ann. Rep. New York State Geol., 1883, pl. 39, figs. 33–36.

Loc. Schoharie and Albany counties, New York; Frankstown, Pennsylvania; Cumberland, Maryland; Cayuga, Ontario.

Obs. This species does not occur in Germany according to Kayser.

HOMŒOSPIRA Hall and Clarke. Genotype Rhynchospira evax Hall.

Homœospira Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 112;—Thirteenth Ann. Rep. New York State Geologist, 1895, p. 792.

Homœospira apriniformis Hall. Niagara (Sil.).

Atrypa aprinis Hall (non de Verneuil), Pal. New York, II, 1852, p. 280, pl. 57, fig. 7.

Rhynchospira? aprinis Hall, Twelfth Rep. New York State Cab. Nat. Hist., 1859, p. 77.

Rhynchospira apriniformis Hall, Pal. New York, III, 1859, p. 485.

Rhynchonella aprinis Miller, N. American Geol. Pal., 1889, p. 367.

Homœospira apriniformis Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 111, pl. 83, figs. 24, 25.

Loc. Lockport, New York.

Homœospira evax Hall. Niagara (Sil.).

Rhynchospira evax Hall, Trans. Albany Institute, IV, 1863, p. 213.

Retzia evax Hall, Twenty-eighth Rep. New York State Mus. Nat. Hist., 1879, p. 160, pl. 25, figs. 13–21;—Eleventh Rep. State Geol. Indiana, 1882, p. 302, pl. 25, figs. 13–21.—Beecher and Clarke, Mem. New York State Mus., I, 1889, p. 55, pl. 5, figs. 1–9.

Homœospira evax Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 112, pl. 50, figs. 15–20 (?32–35).

Loc. Waldron, Indiana; ?Perry County, Tennessee.

Homœospira sobrina (Beecher and Clarke). Niagara (Sil.).

Retzia sobrina Beecher and Clarke, Mem. New York State Mus., I, 1889, p. 61, pl. 5, figs. 10–16.

Homœospira sobrina Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 112, pl. 50, figs. 26–28.

Loc. Waldron, Indiana.

HUSTEDIA Hall and Clarke. Genotype Terebratula mormoni Marcou.

Hustedia Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 120;—Thirteenth Ann. Rep. New York State Geologist, 1895, p. 797.

Hustedia(?) meekana (Shumard). Upper Carboniferous.

Retzia(?) meekana Shumard, Trans. St. Louis Acad. Sci., I, 1858, p. 295, pl. 11, fig. 7.

Loc. Guadalupe Mountains, New Mexico.

Hustedia mormoni (Marcou). Upper Carboniferous.

Terebratula mormoni Marcou, Geol. N. America, February, 1858, p. 51, pl. 6, fig. 11;—Trans. St. Louis Acad. Sci., III, 1875, p. 252.

Retzia punctulifera Shumard, Trans. St. Louis Acad. Sci., I, June, 1858, p. 220.—McChesney, Trans. Chicago Acad. Sci., I, 1868, p. 32, pl. 1, fig. 1.—Meek, Final Rep. U. S. Geol. Survey Nebraska, 1872, p. 181, pl. 1, fig. 13; pl. 5, fig. 7.

Hustedia mormoni (Marcou)—Continued.

Retzia mormoni Meek and Hayden, Proc. Acad. Nat. Sci. Philadelphia, 1859, p. 27.—Geinitz, Carb. u. Dyas Nebraska, 1866, p. 39, pl. 3, fig. 6.—White, Wheeler's Expl. Survey west 100th Merid., IV, 1875, p. 141, pl. 10, fig. 7;—Thirteenth Rep. State Geol. Indiana, 1884, p. 136, pl. 35, figs. 10–12.—Keyes, Proc. Acad. Nat. Sci. Philadelphia, 1888, p. 231;—Geol. Survey Missouri, V, 1895, p. 95, pl. 41, fig. 2.

Retzia subglobosa McChesney, Descriptions New Pal. Foss., 1860, p. 45;—Ibidem, 1865, pl. 1, fig. 1.

Retzia compressa Meek, Geol. Survey California, I, 1864, p. 14, pl. 2, fig. 7.—Kayser, Richthofens China, IV, 1883, p. 176, pl. 22, figs. 1–4.

Eumetria punctulifera Derby, Bull. Cornell Univ., I, 1874, p. 4, pl. 8, figs. 4, 5, 7, 8, 10; pl. 9, fig. 3.

Retzia radialis Walcott (non Phillips), Mon. U. S. Geol. Survey, VIII, 1884, p. 220, pl 7, figs. 5d–5h.—Smith, Proc. American Phil. Soc., XXXV, 1897, p. 31.

Hustedia mormoni Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 120, fig. 106; pl. 51, figs. 1–9.

Loc. Salt Lake City, Utah; Santa Fe, New Mexico; Nevada; Shasta County, California; Nebraska; Kansas; Arkansas; Missouri; Iowa; Illinois; Indiana; Bomjardim and Itaituba, Brazil; Lo Ping, China.

Hustedia(?) papillata (Shumard). Upper Carboniferous.

Retzia papillata Shumard, Trans. St. Louis Acad. Sci., I, 1858, p. 294, pl. 11, fig. 9.

Loc. Guadalupe Mountains, New Mexico.

Obs. Compare with H. mormoni.

Hustedia(?) triangularis (Miller). Chouteau (L. Carb.).

Retzia triangularis Miller, Eighteenth Ann. Rep. Geol. Survey Indiana, 1894, p. 315, pl. 9, figs. 25, 26.

Loc. Sedalia, Missouri.

HYATTELLA Hall and Clarke. Genotype Atrypa congesta Conrad.

Hyattella Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 61, fig. 45;—Thirteenth Ann. Rep. New York State Geologist, 1895, p. 767.

Hyattella congesta (Conrad). Clinton (Sil.).

Atrypa congesta Conrad, Jour. Acad. Nat. Sci. Philadelphia, VIII, 1842, p. 265, pl. 16, fig. 18.—Hall, Geol. New York; Rep. Fourth Dist., 1843, p. 71, fig. 2;—Pal. New York, II, 1852, p. 67, pl. 23, fig. 1.—Billings, Canadian Nat. Geol., I, 1856, p. 136, pl. 2, fig. 4.—Rogers, Geol. Pennsylvania, II, Pt. II, 1858, p. 823, fig. 632.

Atrypa quadricostata Hall, Pal. New York, II, 1852, p. 68, pl. 23, fig. 2.

Triplesia? congesta Hall, Twelfth Rep. New York State Cab. Nat. Hist., 1859, p. 77.

Triplesia? quadricostata Hall, Ibidem, 1859, p. 78.

Rhynchonella quadricostata Miller, N. American Geol. Pal., 1889, p. 369.

Camerella congesta Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 48.

Hyattella congesta Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 61, fig. 45; pl. 40, figs. 23–28; pl. 81, figs. 26–28.

Loc. Rochester, Reynales Basin, etc., New York; Flamborough Head, Ontario; Pennsylvania; Louisville, Kentucky.

Hyattella junia (Billings). Anticosti (Sil.).

Athyris junia Billings, Catalogue Sil. Foss. Anticosti, 1866, p. 46.

Hyattella junia Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 62, pl. 40, figs. 29–31.

Loc. Anticosti.

HYPOTHYRIS King. Genotype Atrypa cuboides Sowerby.

Hypothyris King (non Phillips), Ann. Mag. Nat. Hist., XVIII, 1846, p. 28;—Mon. Permian Foss., Pal. Soc., 1850, pp. 81, 100, 111.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 200;—Thirteenth Ann. Rep. New York State Geologist, 1895, p. 828.

Hypothyris castanea (Meek). Middle Devonian.

Rhynchonella castanea Meek, Trans. Chicago Acad. Sci., I, 1868, p. 93, pl. 13, fig. 9.—Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 153, pl. 15, figs. 1, 4.—Whiteaves, Cont. to Canadian Pal., I, 1891, p. 232.

Liorhynchus castaneus Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 59, figs. 28, 29.

Loc. Lockhart and Mackenzie River, Canada; Eureka district, Nevada.

Hypothyris cuboides (Sowerby). Tully (Dev.).

Atrypa cuboides Sowerby, Trans. Geological Soc., 2d ser., V, 1840, pl. 6, fig. 24.—Vanuxem, Geol. New York; Rep. Third Dist., 1842, p. 163, fig. 1.—Hall, Ibidem, Rep. Fourth Dist., 1843, pp. 215, 216, fig. 1.

Rhynchonella venustula Hall, Pal. New York, IV, 1867, p. 346, pl. 54A, figs. 24–43.—Williams, Bull. Geol. Soc. America, I, 1890, p. 493, pl. 13, figs. 4, 8, 14, 23, 24, 27, 29, 31–34.

Hypothyris cuboides and venustula Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 200, pl. 60, figs. 49–55.

Loc. Europe; Tully, Ovid, Penn Yan, etc., New York.

Hypothyris emmonsi (Hall and Whitfield). Middle Devonian.

Rhynchonella emmonsi Hall and Whitfield, King's U. S. Geol. Expl. 40th Parl., IV, 1877, p. 247, pl. 3, figs. 4–8.—Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 157.

Rhynchonella intermedia Barris, Proc. Davenport Acad. Nat. Sci., II, 1878, p. 285, pl. 11, figs. 5, 6.

Rhynchonella cuboides Whiteaves, Cont. to Canadian Pal., I, 1891, p. 231.

Hypothyris emmonsi and intermedia Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 200.

Loc. White Pine district, Nevada; Davenport, Iowa; Hay and Peace rivers, Canada.

IPHIDEA Billings. Genotype Iphidea bella Billings.

Iphidea Billings, Canadian Nat. Geol., n. ser., VI, 1872, p. 477;—Pal. Fossils, II, 1874, p. 76.—Walcott, Bull. U. S. Geol. Survey, 30, 1886, p. 100.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 97, 166;—Eleventh Ann. Rep. New York State Geologist, 1894, p. 249.—Walcott, Proc. U. S. National Mus., XIX, 1897, p. 707.

Micromitra Meek, Sixth Ann. Rep. U. S. Geol. Survey Terr., 1873, p. 479.

Kutorgina (pars) Dall, Bull. U. S. National Mus., 8, 1877, p. 40.—Walcott, Bull. U. S. Geol. Survey, 30, 1886, p. 101.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 90.

Paterina Beecher, American Jour. Science, 3d ser., XLI, 1891, p. 345.—Hall and Clarke, Eleventh Rep. N. Y. State Geologist, 1894, p. 247.

Iphidea alabamaensis Walcott. Middle Cambrian.

Iphidea alabamaensis Walcott, Proc. U. S. National Mus., XIX, 1897, p. 713, pl. 59, figs. 5, 5a.

Loc. Coosa Valley, Cherokee County, Alabama; near Rogersville, Tennessee.

Iphidea bella Billings. Lower Cambrian.

Iphidea bella Billings, Canadian Nat. Geol., n. ser., VI, 1872, p. 447, fig. 13;—Pal. Fossils, II, 1874, p. 76, fig. 44.—Walcott, Bull. U. S. Geol. Survey, 30, 1886,

Iphidea bella Billings—Continued.

p. 100, pl. 7, fig. 4;—Tenth Ann. Rep. U. S. Geol. Survey, 1891, p. 608, pl. 67, fig. 6.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 98, fig. 54, pl. 4, figs. 8, 9.

Loc. Trois Pistoles, below Quebec, Canada; Anse au Loup, Labrador.

Iphidea crenistria Walcott. Middle Cambrian.

Iphidea crenistria Walcott, Proc. U. S. National Mus., XIX, 1897, p. 713, pl. 59, figs. 4–4b.

Loc. Grand Canyon of the Colorado.

Iphidea labradorica (Billings). Lower Cambrian.

Obolus labradoricus Billings, Geol. Vermont, II, 1861, p. 946, fig. 345;—Pal. Fossils, I, 1861, p. 6, fig. 6;—Geol. of Canada, 1863, p. 284, fig. 291.

Kutorgina labradorica Walcott, Bull. U. S. Geol. Survey, 30, 1886, p. 104, pl. 9, fig. 2;—Tenth Ann. Rep. U. S. Geol. Survey, 1891, p. 609, pl. 69, fig. 3.

Paterina labradorica Beecher, American Jour. Sci., 3d ser., XLI, 1891, pp. 345, 356, pl. 17, figs. 1, 2.

Loc. Anse au Loup, Straits of Belle Isle, Labrador; Conception Bay, Newfoundland.

Iphidea labradorica swantonensis Walcott. Lower Cambrian.

Kutorgina labradorica var. swantonensis Walcott, Proc. U. S. Nat. Mus., XII, 1889, p. 36;—Tenth Ann. Rep. U. S. Geol. Survey, 1891, p. 609, pl. 69, fig. 2.

Loc. East of Swanton and Highgate Springs, Vermont.

Iphidea logani Walcott. Middle Cambrian.

Iphidea logani Walcott, Proc. U. S. National Mus., XIX, 1897, p. 711, pl. 59, figs. 2–2b.

Loc. Trois Pistoles, Quebec, Canada.

Iphidea ornatella Hall and Clarke=I. superba.

Iphidea pannulus (White). Lower and Middle Cambrian.

Trematis pannulus White, Wheeler's Expl. Survey west 100th Merid., Prel. Rep., 1874, p. 6.

Trematis? pannulus White, Ibidem, Final Rep., IV, 1875, p. 36, pl. 1, fig. 4.

Kutorgina pannula Walcott, Bull. U. S. Geol. Survey, 30, 1886, p. 105, pl. 7, fig. 3; pl. 8, fig. 2;—American Jour. Sci., 3d ser., XXXIV, 1887, p. 190, pl. 1, fig. 14;—Tenth Ann. Rep. U. S. Geol. Survey, 1891, p. 609, pl. 69, fig. 5.

Loc. Pioche, Nevada; Wasatch Mountains, Utah; Mount Stephan and Castle Mountain, British Columbia; Washington County, New York; Island of Orleans in the Sillery conglomerate.

Iphidea pealei Walcott. Middle Cambrian.

Iphidea pealei Walcott, Proc. U. S. National Mus., XIX, 1897, p. 712, pl. 59, figs. 3–3c.

Loc. Near Hillsdale, Montana.

Iphidea prospectensis Walcott. Lower Cambrian.

Kutorgina prospectensis Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 19, pl. 9, fig. 1;—Bull. U. S. Geol. Survey, 30, 1886, p. 106, pl. 9, fig. 3;—Tenth Ann. Rep. U. S. Geol. Survey, 1891, p. 610, pl. 69, fig. 4.

Loc. Eureka district, Nevada.

Iphidea sculptilis Meek. Upper Cambrian.

Iphidea (??) sculptilis Meek, Sixth Ann. Rep. U. S. Geol. Survey Territories, 1873, p. 479.

Micromitra sculptilis Meek, Ibidem, 1873, p. 479.

Kutorgina minutissima Hall and Whitfield, King's U. S. Geol. Expl. 40th Parl., IV, 1877, p. 207, pl. 1, figs. 11, 12.

Iphidea sculptilis Meek—Continued.

Kutorgina sculptilis Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 20, pl. 1, fig. 7; pl. 9, fig. 7.

Loc. Gallatin City, Montana; Eureka district, Nevada.

Obs. The ventral pedicle foramen in this species, the genotype of Micromitra, is partially closed posteriorly, but otherwise does not seem to differ generically from Iphidea.

Iphidea stissingensis (Dwight). Middle Cambrian.

Kutorgina stissingensis Dwight, American Jour. Sci., 3d ser., XXXVIII, 1889, p. 145, pl. 6, figs. 5–8;—Trans. Vassar Brothers' Inst., V, 1891, p. 105, pl. 1, figs. 5–8.

Loc. Stissing Mountain, Duchess County, New York.

Iphidea superba Walcott. Middle Cambrian.

Iphidea cnf. ? ornatella Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 4, figs. 6, 7.

Iphidea superba Walcott, Proc. U. S. National Mus., XIX, 1897, p. 711, pl. 59, figs. 1-1c.

Loc. Grand Canyon of the Colorado.

Isogramma Meek and Worthen=Aulacorhynchus.

Isogramma millipunctata Meek and Worthen=Aulacorhynchus millipunctatum.

KINGENA Davidson. Genotype Terebratula lima Defrance.

Kingena Davidson, Mon. British Cret. Brach., Pal. Soc., I, 1853, p. 42.

Kingena leonensis (Conrad). Washita (Lower Cret.).

Terebratula leonensis Conrad, Emory's Rep. U. S. and Mexican Bound. Survey, I, 1857, p. 164, pl. 21, fig. 2.—Gabb, Proc. Acad. Nat. Sci. Philadelphia, 1861, p. 18.

Loc. Leon Springs, Texas; also Denison, Texas (Hill).

Kingena wacoensis (Roemer). Washita (Lower Cret.).

Terebratula sp. undet. Roemer, Texas, 1849, p. 408.

Terebratula wacoensis Roemer, Kreidebildung von Texas, 1852, p. 81, pl. 6, fig. 2.—Gabb, Proc. Acad. Nat. Sci. Philadelphia, 1861, p. 18.

Terebratula choctawensis Shumard, Marcy's Rep. Red River Louisiana, 1854, p. 195, pl. 2, fig. 3.—Gabb, Proc. Acad. Nat. Sci. Philadelphia, 1861, p. 19.

?Terebratula wacoensis Whiteaves, Mesozoic Foss., Geol. Surv. Canada, I, 1879, p. 177.

Loc. Near New Braunfels, Texas; Trent River, Vancouver Island. "I have traced its continuity from the Red River to the Rio Grande" (Hill).

Obs. Gabb is correct in regarding T. choctawensis as a synonym for T. wacoensis. "The Vancouver specimens are doubtful" (Stanton).

Klitambonites Pander=Clitambonites.

Koninckiana americana Swallow=Productus swallovi.

KUTORGINA Billings. Genotype Obolella cingulata Billings.

Kutorgina Billings (partim), Geol. Vermont, II, 1861, p. 948, figs. 347–349.—Billings (partim), Pal. Fossils, I, 1861, p. 9, figs. 8–10.—Dall, Bull. U. S. Nat. Mus., 8, 1877, p. 40.—Walcott (partim), Bull. U. S. Geol. Survey, 30, 1886, p. 101.—Beecher, American Jour. Sci., 3d ser., XLI, 1891, p. 345.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 90, 166, 183;—Eleventh Ann. Rep. New York State Geologist, 1894, p. 247.

Kutorgina cingulata Billings. Lower Cambrian.

Obolella (Kutorgina) cingulata Billings, Geol. Vermont, II, 1861, p. 948, figs. 347-349;—Pal. Fossils, I, 1861, p. 8, figs. 8-10.

Obolella cingulata Billings, Geol. Canada, 1863, p. 284, fig. 287.

Kutorgina cingulata Walcott, Bull. U. S. Geol. Survey, 30, 1886, p. 102, pl. 9, fig. 1.—Beecher, American Jour. Sci., 3d ser., XLI, 1891, p. 345.—Walcott, Tenth Ann. Rep. U. S. Geol. Survey, 1891, p. 609, pl. 69, fig. 1.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 92, figs. 47-49; pl. 4, figs. 10-17.

Loc. Anse au Loup, Labrador; Swanton and Georgia, Vermont; Malvern Hills, England; Island of Bornholm, Sweden.

Kutorgina labradorica Walcott=Iphidea labradorica.

Kutorgina labradorica var. swantonensis Walcott=Iphidea labradorica swantonensis.

Kutorgina latourensis Matthew=Billingsella latourensis.

Kutorgina minutissima Hall and Whitfield=Iphidea sculptilis.

Kutorgina pannula White=Iphidea pannulus.

Kutorgina prospectensis Walcott=Iphidea prospectensis.

?Kutorgina pterineoides Matthew. Middle Cambrian.

Kutorgina ? pterineoides Matthew, Trans. Royal Soc. Canada, III, 1886, p. 43, pl. 5, fig. 19.

Loc. Hanford Brook and St. Martins, New Brunswick.

Obs. It is not certain that this species is a brachiopod. May be the operculum of a pteropod.

Kutorgina sculptilis Walcott=Iphidea sculptilis.

Kutorgina stissingensis Dwight=Iphidea stissingensis.

Kutorgina whitfieldi Walcott=Billingsella whitfieldi.

LEIORHYNCHUS Hall. Genotype Orthis quadricostata Vanuxem.

Leiorhynchus Hall, Thirteenth Rep. New York State Cab. Nat. Hist., 1860, p. 75;—Twentieth Rep. Ibidem, 1867, p. 272;—Pal. New York, IV, 1867, p. 355.—Waagen, Palæontologica Indica, Ser. XIII, I, 1883, p. 411.

Liorhynchus Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 193;—Thirteenth Ann. Rep. New York State Geologist, 1895, p. 827.

Obs. A subgenus of Camarotœchia, differing only in exterior ornamentation.

Leiorhynchus boonense (Shumard). Burlington (L. Carb.).

Rhynchonella boonensis Shumard, Geol. Rep. Missouri, 1855, p. 205, pl. C, fig. 6.—Keyes, Geol. Survey Missouri, V, 1895, p. 101.

Liorhynchus boonensis Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 194, pl. 60, fig. 35.

Loc. Columbia, Boone County, and Cooper County, Missouri.

Leiorhynchus dubium Hall. Marcellus (Dev.).

Leiorhynchus dubius Hall, Pal. New York, IV, 1867, p. 364, pl. 56, figs. 22-25.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 59, figs. 6, 7.

Rhynchonella dubia Tschernyschew, Mém. Comité Géologique de St. Petersburg, III, 3, 1887, p. 90, pl. 14, fig. 7.

Loc. New York; Urals of Russia.

Leiorhynchus globuliforme (Vanuxem). Chemung (Dev.).

Atrypa globuliformis Vanuxem, Geol. New York; Rep. Third Dist., 1842, p. 182, fig. 2.

Leiorhynchus globuliformis Hall, Pal. New York, IV, 1867, p. 364, pl. 57, figs. 26-29.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 194, pl. 59, figs. 23-27.

Loc. Otsego County, New York.

Leiorhynchus greeneanum (Ulrich). Waverly (L. Carb.).

Rhynchonella greenana Ulrich, Cont. American Pal., I, 1886, p. 26, pl. 3, fig. 1.

Liorhynchus greenianus Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 194.

Pugnax greenianus Hall and Clarke, Ibidem, 1895, pl. 60, figs. 36–38.

Loc. Near New Albany, Indiana.

Leiorhynchus (?) hecate Clarke. Genesee (Dev.).

Leiorhynchus(?) hecate Clarke, Bull. U. S. Geol. Survey, 16, 1885, p. 31, pl. 3, fig. 4.

Loc. Ontario County, New York.

Obs. Probably the same as Spirifer pluto Clarke.

Leiorhynchus iris Hall. Chemung (Dev.).

Leiorhynchus iris Hall, Pal. New York, IV, 1867, p. 360, pl. 56, figs. 41–43.

Loc. Rockford, Iowa.

Leiorhynchus kelloggi Hall. Hamilton (Dev.).

Leiorhynchus kelloggi Hall, Pal. New York, IV, 1867, p. 361, pl. 57, figs. 1–12.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 194, pl. 59, figs. 18–20, 32, 33.

Leiorhynchus kelloggi? Whitfield, Geol. Wisconsin, IV, 1882, p. 334, pl. 26, fig. 9.

Rhynchonella kelloggi Tschernyschew, Mém. Comité Géologique de St. Petersburg, III, 3, 1887, p. 91, pl. 14, fig. 14.

Loc. Ohio; New York; Milwaukee, Wisconsin; Urals of Russia.

Leiorhynchus laura (Billings). Marcellus-Hamilton (Dev.).

Rhynchonella? laura Billings, Canadian Jour., V, May, 1860, p. 273, figs. 26–28;—Geol. Canada, 1863, p. 384, fig. 418.

Leiorhynchus multicosta Hall, Thirteenth Rep. New York State Cab. Nat. Hist., December, 1860, p. 85, figs. 14, 15, on p. 94;—Pal. New York, IV, 1867, p. 358, pl. 56, figs. 26–40.

Leiorhynchus laura Billings, Canadian Nat. Geol., n. ser., VII, 1874, p. 240.

Rhynchonella (Leiorhynchus) laura Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 159.

†Rhynchonella multicosta Tschernyschew, Devon. im Donetz Becken, 1886, pl. 15, figs. 1–3;—Mém. Comité Géologique de St. Petersburg, III, 3, 1887, p. 92.

Liorhynchus multicosta and laura Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 194, pl. 59, figs. 8–10, 13–17.

Loc. Thedford and Bosanquet, Ontario; New York; Eureka district, Nevada; †Russia.

Leiorhynchus lesleyi Hall and Clarke. Upper Devonian.

Liorhynchus lesleyi Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, p. 368, pl. 59, figs. 34–36.

Loc. "Pennsylvania."

Leiorhynchus limitare (Vanuxem). Marcellus (Dev.).

Orthis limitaris Vanuxem, Geol. New York; Rep. Third Dist., 1842, p. 146, fig. 3.

Atrypa limitaris Hall, Ibidem, Rep. Fourth Dist., 1843, p. 182, fig. 11.

Leiorhynchus limitaris Hall, Thirteenth Rep. New York State Cab. Nat Hist., 1860, p. 85;—Pal. New York, IV, 1867, p. 356, pl. 56, figs. 6–21.—Whitfield, Annals New York Acad. Sci., V, 1891, p. 550, pl. 11, fig. 11;—Geol. Ohio, VII, 1895, p. 444, pl. 7, fig. 11.

Rhynchonella limitaris Tschernyschew, Mémoires du Comité Géologique de St. Petersburg, 1887, III, 3, pl. 14, fig. 5.

Liorhynchus limitaris Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 194, pl. 59, figs. 12, 35.

Loc. Schoharie, Marcellus, Avon, etc., New York; Delaware County, Ohio (Whitfield); Urals of Russia.

Leiorhynchus mesicostale Hall. Portage-Chemung (Dev.).

Atrypa mesacostalis Hall, Geol. New York; Rep. Fourth Dist., 1843, Tables Organic Remains, 64, fig. 1.

Leiorhynchus mesacostalis Hall, Thirteenth Rep. New York State Cab. Nat. Hist., 1860, p. 86, fig. 1;—Pal. New York, IV, 1867, p. 362, pl. 67, figs. 18–25.—Kindle, Bull. American Pal., 6, 1896, p. 37.

Rhynchonella mesacostalis Tschernyschew, Mémoires du Comité Géologique de St. Petersburg, 1887, p. 91, pl. 14, figs. 3, 4.

Liorhynchus mesacostalis Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 194, pl. 59, figs. 11, 12.

Loc. Ithaca, Elmira, Bath, etc., New York; Urals of Russia.

Leiorhynchus multicosta Hall=L. laura.

Leiorhynchus mysia Hall. Marcellus (Dev.).

Leiorhynchus mysia Hall, Pal. New York, IV, 1867, p. 357, pl. 56, figs. 1–5.

Loc. Schoharie, New York.

Leiorhynchus nevadaense Walcott. Middle Devonian.

Rhynchonella (Leiorhynchus) nevadensis Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 157, pl. 14, fig. 9.

Loc. Eureka district, Nevada.

Leiorhynchus newberryi Hall. Waverly (L. Carb.).

Leiorhynchus newberryi Hall, Twenty-third Rep. New York State Cab. Nat. Hist., 1873, p. 240, pl. 11, figs. 25–27.

Liorhynchus newberryi Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 194, pl. 59, figs. 37, 38.

Loc. Kelloggsville, Ashtabula County, Ohio.

Leiorhynchus quadricostatum (Vanuxem). Genesee (Dev.).

Orthis quadricostata Vanuxem, Geol. New York; Rep. Third Dist., 1842, p. 168, fig. 2.

Atrypa (Orthis) quadricostata Hall, Ibidem, Rep. Fourth Dist., 1843, p. 223, fig. 2.

Leiorhynchus quadricostata Hall, Thirteenth Rep. New York State Cab. Nat. Hist., 1860, p. 86;—Pal. New York, IV, 1867, p. 357, pl. 56, figs. 44–49.—Clarke, Bull. U. S. Geol. Survey, 16, 1885, p. 24.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 71.

Leiorhynchus quadricostata? Meek, King's U. S. Geol. Expl. 40th Parl., IV, 1877, p. 79, pl. 3, fig. 9.

Liorhynchus quadricostatus Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 193, pl. 59, figs. 21, 22.

Loc. Ithaca, Seneca Lake, Cayuga Lake, New York; Falls of Ohio; White Pine district, Nevada.

Leiorhynchus robustum Hall and Clarke. Chemung (Dev.).

Liorhynchus robustus Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pl. 59, figs. 30, 31.

Loc. Steuben County, New York.

Leiorhynchus sesquiplicatum A. Winchell. Hamilton (Dev.).

Leiorhynchus sesquiplicatus A. Winchell, Rep. Lower Peninsula Michigan, 1866, p. 95.

Loc. Grand Traverse district, Michigan.

Leiorhynchus sinuatum Hall. Chemung (Dev.).

Leiorhynchus sinuatus Hall, Pal. New York, IV, 1867, p. 362, pl. 57, figs. 13–17.

Rhynchonella (Leiorhynchus) sinuatus Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 158, pl. 14, fig. 5.

Liorhynchus sinuatus Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 194.

Loc. Ithaca and Chemung Narrows, New York; Eureka district, Nevada.

LEPTÆNA Dalman.

Genotype Productus rugosa Hisinger=Conchita rhomboidalis Wilckens.

Leptæna Dalman, Kongl. Svenska Vet.-Akad. Handl., för 1827, 1828, pp. 93, 94.—King, Mon. Permian Foss., Pal. Soc., 1850, p. 104.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 276.—Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 409.—Hall and Clarke, Eleventh Ann. Rep. New York State Geologist, 1894, p. 277.

Leptagonia McCoy, Carb. Foss. Ireland, 1844, p. 116.

Plectambonites Œhlert, Fischer's Manuel Conchyliologie, 1887, p. 1283.

Leptæna alternata Conrad=Rafinesquina alternata.

Leptæna alternistriata Hall=Rafinesquina alternata alternistriata.

Leptæna barabuensis Whitfield=Syntrophia barabuensis.

Leptæna bipartita Hall=Strophomena bipartita.

Leptæna camerata Hall=Rafinesquina camerata.

Leptæna charlottæ Winchell and Schuchert. Trenton (Ord.).

Leptæna charlottæ Winchell and Schuchert, American Geol., IX, April 1, 1892, p. 288;—Minnesota Geol. Survey, III, 1893, p. 410, pl. 32, figs. 1–5.

Strophomena halli Sardeson, Bull. Minnesota Acad. Nat. Sci., III, April 9, 1892, p. 334, pl. 4, figs. 36–38.

Loc. Minneapolis and St. Paul, Minnesota.

Leptæna concava Hall=Leptænisca concava.

Leptæna corrugata Hall=Strophomena corrugata.

Leptæna decipiens Billings=Leptella decipiens.

Leptæna deflecta Hall=Dinorthis deflecta.

Leptæna deltoidea=Rafinesquina deltoidea and R. minnesotaensis.

Leptæna depressa Hall=L. rhomboidalis.

Leptæna fasciata Hall=Rafinesquina fasciata.

Leptæna incrassata Hall=Rafinesquina incrassata.

Leptæna indenta Conrad=Strophеodonta indenta.

Leptæna julia Shaler=Strophomena julia.

Leptæna laticosta de Verneuil=Tropidoleptus carinatus.

Leptæna melita Hall and Whitfield=Dalmanella melita.

Leptæna mesacosta Shumard=Rafinesquina mesicosta.

Leptæna minnesotensis Sardeson=Plectambonites sericeus.

Leptæna nucleata Hall=Anoplia nucleata.

Leptæna obscura Hall=Rafinesquina obscura.

Leptæna orthididea Hall=Strophonella orthididea.

Leptæna patenta Hall=Strophonella patenta.

Leptæna planoconvexa Hall=Strophomena planiconvexa.

Leptæna planumbona Hall=Strophomena rugosa.

Leptæna plicatella Ulrich=Plectambonites plicatellus.

Leptæna plicifera Hall=Dalmanella? plicifera.

Leptæna præcosis Sardeson=Plectambonites sericeus.

Leptæna profunda Hall=Strophеodonta profunda.

Leptæna prolongata Foerste=Plectambonites transversalis prolongatus.

Leptæna punctulifera Conrad=Strophonella punctulifera.

Leptæna quadrilatera Shaler=L. rhomboidalis.

Leptæna recedens Sardeson=Plectambonites sericeus.

Leptæna recta Hall=Dinorthis deflecta.

Leptæna rhomboidalis (Wilckens). Trenton-Waverly (Ord.-L. Carb.).

Conchita rhomboidalis Wilckens, Nachricht von selten Versteinerungen, 1769, p. 77, pl. 8, figs. 43, 44.

Strophomena undulosa Conrad, Fifth Ann. Rep. Geol. Survey New York, 1841, p. 54.

Strophomena depressa Vanuxem, Geol. New York; Rep. Third Dist., 1842, p. 79, fig. 5.—Hall, Ibidem, Rep. Fourth Dist., 1843, p. 77, fig. 5; p. 104, fig. 2.—Billings, Canadian Nat. Geol., I, 1856, p. 59, pl. 1, fig. 5.—Roemer, Sil. Fauna west. Tennessee, 1860, p. 65, pl. 5, fig. 2.

Strophomena undulatus Vanuxem, Geol. New York; Rep. Third Dist., 1842, p. 139, fig. 3.

Strophomena undulata Hall, Ibidem, Rep. Fourth Dist., 1843, p. 175, fig. 3.—Yandell and Shumard, Cont. Geol. Kentucky, 1847, p. 11.

Productus? sulcatus Castelnau, Essai Syst. Sil. l'Amérique Septentrionale, 1843, p. 39, pl. 13, fig. 7.

Productus sulcifer de Verneuil, Ibidem, 1843, p. 39.

Leptæna tenuistriata Hall, Pal. New York, I, 1847, p. 108, pl. 31A, fig. 4.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 8, figs. 12–16.

Leptæna depressa Hall, Pal. New York, II, 1852, p. 62, pl. 21, fig. 8; p. 257, pl. 53, fig. 6.—Rogers, Geol. Pennsylvania, II, Pt. II, 1858, p. 823, fig. 630.

Strophomena rugosa Hall, Pal. New York, III, 1859, p. 195, pl. 19, fig. 1.

Strophomena rhomboidalis Billings, Canadian Jour., VI, 1861, p. 336, figs. 111, 112;—Geol. Canada, 1863, p. 311, fig. 314; p. 367, fig. 373;—Proc. Portland Soc. Nat. Hist., 1863, p. 107, pl. 3, fig. 1.—Hall, Pal. New York, IV, 1867, p. 76, pl. 12, figs. 16–18; p. 414, pl. 15, figs. 15, 16.—Meek and Worthen, Geol. Survey Illinois, III, 1868, p. 426, pl. 10, fig. 7.—Meek, Pal. Ohio, I, 1873, p. 75, pl. 5, fig. 6.—Billings, Pal. Foss., II, 1874, p. 27.—White, Wheeler's Expl. Survey west 100th Merid., IV, 1875, p. 85, pl. 5, fig. 5 —Hall and Whitfield, King's U. S. Geol. Expl. 40th Parl., IV, 1877, p. 253, pl. 4, fig. 4.—Hall, Twenty-eighth Rep. New York State Mus. Nat. Hist., 1879, p. 151, pl. 22, figs. 4–10.—Miller, Jour. Cincinnati Soc. Nat. Hist., IV, 1881, p. 1.—Hall, Eleventh Rep. State Geol. Indiana, 1882, p. 288, pl. 22, figs. 4–10;—Second Ann. Rep. New York State Geol., 1883, pl. 38, figs. 17–31.—Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 118.—Beecher and Clarke, Mem. New York State Mus., I, 1889, p. 18, pl. 2, figs. 1–13.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 150, pl. 18, figs. 1–3.—Foerste, Proc. Boston Soc. Nat. Hist., XXIV, 1890, p. 298.—Beecher, American Jour. Sci., 3d ser., XLI, 1891, p. 357, pl. 17, figs. 18–21.—Herrick, Geol. Ohio, VII, 1895, pl. 20, fig. 6.

Strophomena analoga Davidson, Quart. Jour. Geol. Soc. London, XIX, 1863, p. 173, pl. 9, fig. 18.—Dawson, Acadian Geol., 3d ed., 1878, p. 295, fig. 95.

Leptæna quadrilatera Shaler, Bull. Mus. Comp. Zool., 4, 1865, p. 65.

Strophomena gibbosa James, Cincinnati Quart. Jour. Sci., I, 1874, p. 333.

Strophomena tenuistriata Miller, Ibidem, II, 1875, p. 55.—Hall, Second Ann. Rep. New York State Geol., 1883, pl. 38, figs. 12–16.

Leptæna rhomboidalis Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 279, pl. 8, figs. 17–31; pl. 15A, figs. 40–42; pl. 20, figs. 21–24.—Foerste, Geol. Ohio, VII, 1895, p. 566.

Leptæna (Strophomena) rhomboidalis, Beecher, American Jour. Sci., 3d ser., XLIV, 1892, p. 150, pl. 1, figs. 7–9.

Plectambonites rhomboidalis Keyes, Geol. Survey Missouri, V, 1895, p. 70, fig. 6.

Loc. Generally distributed in the above-given formations throughout America and Europe.

Leptæna rhomboidalis ventricosa Hall. Oriskany (Dev.).

Strophomena depressa var. ventricosa Hall, Tenth Rep. New York State Cab. Nat. Hist., 1857, p. 55.

Strophomena rugosa var. ventricosa Hall, Pal. New York, III, 1859, p. 417, pl. 94, figs. 2, 3.

Leptæna rhomboidalis var. ventricosa Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 15A, fig. 43.

Loc. Albany and Schoharie counties, New York; Cumberland, Maryland; Cayuga, Ontario.

Leptæna rugosa=L. rhomboidalis.

Leptæna saxea Sardeson=Plectambonites sericeus.

Leptæna sericea Sowerby=Plectambonites sericeus.

Leptæna sordida Billings=Leptella sordida.

Leptæna(?) stelzneri Kayser. Ordovician.

Leptæna stelzneri Kayser, Palæontographica, Suppl., III, 1876, p. 21, pl. 3, fig. 21.

Loc. Guaco, Argentine Republic.

Obs. Since this species has a high ventral area and a perforated deltidium it is probably a Clitambonites.

Leptæna striata Hall=Strophonella striata.

Leptæna subplana Hall=Orthothetes subplanus.

Leptæna subquadrata Hall=Christiania subquadrata.

Leptæna subtenta Hall=Strophomena trentonensis or S. rugosa subtenta.

Leptæna sulcata de Verneuil=Strophomena sulcata.

Leptæna tenuilineata Hall=Rafinesquina tenuilineata.

Leptæna tenuistriata Hall=L. rhomboidalis.

Leptæna transversalis=Plectambonites transversalis.

Leptæna transversalis var. alabamaensis Foerste = Plectambonites transversalis alabamaensis.

Leptæna trilobata Owen=Strophomena trilobata.

Leptæna unicostata Meek and Worthen. Lorraine (Ord.).

Leptæna (n. sp.?) Owen, Geol. Survey Wisconsin, Iowa, Minnesota, 1852, pl. 2B, fig. 3. [See specimen in U. S. Nat. Mus., Cat. Invert. Foss., 17908.]

Strophomena unicostata Meek and Worthen, Geol. Survey Illinois, III, 1868, p. 335, pl. 4, fig. 11.—Whitfield, Geol. Wisconsin, IV, 1882, p. 262, pl. 12, fig. 14.

Rafinesquina unicostata Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 15A, fig. 39; pl. 20, fig. 25.

Leptæna unicostata Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 411, pl. 32, figs. 6–9.—Whiteaves, Pal. Foss., III, Pt. III, 1897, p. 174.

Loc. Savanna and Wilmington, Illinois; Delafield and Iron Ridge, Wisconsin; Spring Valley and Granger, Minnesota; Lattners, Iowa; Rapids of the Nelson River, Lake Winnipeg, Manitoba.

Leptæna variolata d'Orbigny=Chonetes variolatus.

Leptæna vicina Castelnau=Chonetes vicinus.

LEPTÆNISCA Beecher. Genotype Leptæna concava Hall.

Leptænisca Beecher, American Jour. Sci., 3d ser., XL, 1890, p. 239, pl. 9, figs. 1–5.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 300;—Eleventh Ann. Rep. New York State Geologist, 1894, p. 291.

Leptænisca adnascens Hall and Clarke. Lower Helderberg (Dev.).

Leptænisca adnascens Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 301, 352, pl. 15A, figs. 22, 23.

Loc. Near Clarksville, New York.

Leptænisca concava Hall. Lower Helderberg (Dev.).

Leptæna concava Hall, Tenth Rep. New York State Cab. Nat. Hist., 1857, p. 47;—Pal. New York, III, 1859, p. 197, pl. 18, fig. 2.

Leptæna? (subgenus?) concava Hall, Second Ann. Rep. New York State Geol., 1883, pl. 46, figs. 30, 31.

Leptænisca concava Beecher, American Jour. Sci., 3d ser., XL, 1890, p. 238, pl. 9, figs. 1–5.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 300, pl. 15, figs. 30, 31; pl. 15A, figs. 19–21.

Loc. Albany County, New York; Decatur County, Tennessee.

Leptænisca tangens Hall and Clarke. Lower Helderberg (Dev.).

Leptænisca tangens Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 301, 352, pl. 15A, figs. 24–30.

Loc. Near Clarksville, New York.

LEPTELLA Hall and Clarke. Genotype Leptæna sordida Billings.

Leptella Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 293;—Eleventh Ann. Rep. New York State Geologist, 1894, p. 277.

Leptella decipiens (Billings). Calciferous (Ord.).

Leptæna decipiens Billings, Pal. Fossils, I, 1862, p. 74, fig. 67; p. 219;—Geol. Canada, 1863, p. 231, fig. 243.

Leptella decipiens Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 294.

Loc. Point Levis, Canada; Portland Creek, Newfoundland.

Leptella sordida (Billings). Calciferous (Ord.).

Leptæna sordida Billings, Pal. Fossils, I, 1862, p. 73, fig. 66;—Geol. Canada, 1863, p. 231, fig. 242.

Leptella sordida Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 293, pl. 15A, figs. 12–16.

Loc. Point Levis, Canada.

LEPTOBOLUS Hall. Genotype L. lepis Hall.

Leptobolus Hall, Description n. sp. Foss. from Hudson River Group, 1871, p. 3;—Twenty-fourth Rep. New York State Cab. Nat. Hist., 1872, p. 226.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 73, 165;—Eleventh Ann. Rep. New York State Geologist, 1894, p. 241.

Leptobolus grandis Matthew. Lowest Ordovician.

Leptobolus grandis Matthew, Trans. Royal Soc. Canada, X, 1874, p. 91, pl. 16, fig. 7.

Loc. Hardingville, New Brunswick.

Leptobolus insignis Hall. Utica (Ord.).

Leptobolus insignis Hall, Descrip. n. sp. Foss. from Hudson River Group, 1871, p. 3, pl. 3, fig. 17;—Twenty-fourth Rep. New York State Cab. Nat. Hist., 1872, p. 227, pl. 7, fig. 17.—Nicholson, Pal. Province Ontario, 1875, p. 85.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 74, pl. 3, figs. 1–6.

Loc. Middleville, Utica, etc., New York; Ottawa, Canada; Cincinnati, Ohio.

Leptobolus lepis Hall. Utica (Ord.).

Leptobolus lepis Hall, Description n. sp. Foss. from Hudson River Group, 1871, p. 3, pl. 3, figs. 19, 20;—Twenty-fourth Rep. New York State Cab. Nat. Hist., 1872, p. 226, pl. 7, figs. 19, 20.—Hall and Whitfield, Pal. Ohio, II, 1875, p. 69, pl. 1, figs. 10, 11.—Miller, Cincinnati Quart. Jour. Sci., II, 1875, p. 11.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 74, pl. 3, figs. 8–10.

Loc. Cincinnati, Ohio.

Leptobolus occidentalis Hall. Maquoketa (Ord.).

Leptobolus occidentalis Hall, Description n. sp. Foss. from Hudson River Group, 1871, p. 3, pl. 3, fig. 18;—Twenty-fourth Rep. New York State Cab. Nat. Hist., 1872, p. 227, pl. 7, fig. 18.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 3, fig. 7.

Loc. Hawleys Mills, Iowa; Platteville, Wisconsin; Ottawa, Canada (Ami).

Leptocœlia Hall=Anoplotheca.

Leptocœlia propria Hall=Anoplotheca fiabellites.

Leptocœlia disparilis Hall=Atrypina disparilis.

Leptocœlia imbricata Hall=Atrypina imbricata.

LEPTOSTROPHIA Hall and Clarke.

Genotype Stropheodonta magnifica Hall.

Leptostrophia Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 288;—Eleventh Ann. Rep. New York State Geologist, 1894, p. 281.

Obs. This is a subdivision of Stropheodonta. The following species have been referred to it: S. magnifica, S. perplana, S. textilis, S. beckei, S. magniventra, S. junia, S. irene, S. blainvillei, and S. tullia.

LINDSTRŒMELLA Hall and Clarke. Genotype L. aspidium H. and C.

Lindstrœmella Hall and Clarke, Extract Pal. New York, VIII, 1890, p. 134;—Pal. New York, VIII, Pt. I, 1892, p. 134;—Eleventh Ann. Rep. New York State Geologist, 1894, p. 257.

Lindstrœmella aspidium Hall and Clarke. Hamilton (Dev.).

Lindstrœmella aspidium Hall and Clarke, Extract Pal. New York, VIII, 1890, p. 134, pl. 4E, figs. 25–28;—Pal. New York, VIII, Pt. I, 1892, pp. 134, 178, pl. 4E, figs. 25–28.

Loc. Leonardsville, Hamilton, Darien, etc., New York.

LINGULA Bruguière. Genotype Lingula anatina Lamarck.

Lingula Bruguière, Encyclopédie Méthodique, I, 1792, pl. 250.—Meek and Hayden, Pal. Upper Missouri, Smithsonian Cont. to Knowl., XIV, 172, 1864, p. 68.—Hall, Pal. New York, IV, 1867, p. 5.—Dall, American Jour. Conch., VI, 1870, pp. 153, 154.—Meek, Hayden's U. S. Geol. Survey Terr., IX, 1876, p. 7.—Dall, Bull. U. S. Nat. Museum, 8, 1877, p. 43.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 2, 161.—Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 338.—Hall and Clarke, Eleventh Ann. Rep. New York State Geologist, 1894, p. 226.

Lingula acuminata Hall=Lingulepis acuminata.

Lingula acutangula Roemer=Lingulepis acutangulus.

Lingula acutirostris Hall. Clinton (Sil.).

Lingula acutirostra Hall, Geol. New York; Rep. Fourth Dist., 1843, p. 77, fig. 9 on p. 76;—Pal. New York, II, 1852, p. 56, pl. 20, fig. 5.

Loc. Wolcott, New York.

Obs. Based upon a single specimen now lost.

Lingula æqualis Hall. Trenton (Ord.).

Lingula æqualis Hall, Pal. New York, I, 1847, p. 95, pl. 30, fig. 3.—Walcott, Proc. U. S. Nat. Mus., XI, 1888, p. 480, fig. 3.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 9, fig. 4.

Loc. Middleville, Trenton Falls, and Rome, New York.

Lingula alba-pinensis Walcott. Upper Devonian.

Lingula albapinensis Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 108, pl. 2, fig. 1.

Loc. White Pine district, Nevada.

Lingula alveata Hall=Dignomia alveata.

Lingula ampla Owen=Lingulella ampla.

Lingula antiqua Emmons=Lingulepis acuminata.

Lingula antiqua Hall, 1851, 1862, Hayden, 1863 (non Hall, 1847)=Lingulepis pinniformis.

Lingula antiquata Emmons=Lingulepis acuminata.

Lingula artemis Billings. Gaspé No. 5 (L. Dev.).

Lingula artemis Billings, Pal. Fossils, II, 1874, p. 14, fig. 4.

Loc. Gaspé, Cape Bon Ami.

Lingula atra Herrick. Waverly (L. Carb.).

Lingula atra Herrick, Bull. Denison Univ., IV, 1888, pp. 13, 16, pl. 10, fig. 30;—Geol. Ohio, VII, 1895, pl. 22, figs. 5, 6.

Loc. Cuyahoga River, Ohio.

Lingula attenuata Hall=Glossina trentonensis.

Lingula aurora Hall=Lingulella aurora.

Lingula aurora var. Hall=Lingulella stoneana.

Lingula bolli Billings. Chazy (Ord.).

Lingula belli Billings, Canadian Nat. Geol., IV, 1859, p. 431, figs. 7, 8;—Geol. Canada, 1863, p. 124, fig. 47.

Loc. Island of Montreal, Allumette Island, Canada.

Lingula beltrami Winchell and Schuchert. Lorraine (Ord.).

Lingula beltrami Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 351, figs. 25a, 25b.

Loc. Spring Valley, Minnesota.

Lingula bicarinata Ringueberg. Niagara (Sil.).

Lingula bicarinata Ringueberg, Proc. Acad. Nat. Sci. Philadelphia, 1884, p. 149, pl. 3, fig. 8.—Miller, N. American Geol. Pal., 1889, p. 349.

Loc. Lockport, New York.

Lingula billingsana Whitcaves=Lingulella billingsana.

Lingula bisulcata Ulrich. Utica (Ord.).

Lingula bisulcata Ulrich, American Geologist, III, 1889, p. 380, fig. 2, on p. 378.

Loc. Ludlow, Kentucky.

Lingula brevirostris Meek and Hayden. Jurassic.

Lingula brevirostris Meek and Hayden, Proc. Acad. Nat. Sci. Philadelphia, 1858, p. 50;—Ibidem, 1860, p. 419;—Pal. Upper Missouri, Smithsonian Cont. to Knowl., XIV, 172, 1865, p. 69, pl. 3, fig. 3.—Whitfield, Powell's Geol. Geogr. Survey Rocky Mt. Region, 1880, p. 346, pl. 3, figs. 4, 5.

Loc. Black Hills, Dakota.

Lingula briseis Billings. Trenton (Ord.).

Lingula briseis Billings, Pal. Fossils, I, 1862, p. 48, fig. 52;—Geol. Canada, 1863, p. 161, fig. 136.

Loc. Bayonne River, Canada.

Lingula (??) calumet N. H. Winchell. ?Cambrian.

Lingula calumet N. H. Winchell, Thirteenth Ann. Rep. Geol. Nat. Hist. Survey Minnesota, 1885, p. 65.—Miller, N. American Geol. Pal., 1889, p. 349.

Loc. Pipestone, Minnesota.

Obs. It is not certain that these specimens are organic.

Lingula(?) canadaensis Billings. Trenton and Lorraine (Ord.).

Lingula canadensis Billings, Pal. Fossils, I, 1862, p. 114, fig. 95;—Geol. Canada, 1863, p. 210, fig. 209.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 27.—Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 352, fig. 26.

Loc. Anticosti; in the Galena at Mantorville and Hader, Minnesota.

Lingula carbonaria Shumard. Upper Carboniferous.

Lingula carbonaria Shumard, Trans. St. Louis Acad. Sci., I, 1858, p. 215.

Loc. Clarke County, Missouri.

Lingula centrilineata Hall. Lower Helderberg (Dev.).

Lingula centrilineata Hall, Pal. New York, III, 1859, p. 155, pl. 9, figs. 1, 2.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 15.

Loc. Albany County, New York.

Lingula ceryx Hall. Schoharie (Dev.).

Lingula ceryx Hall, Sixteenth Rep. New York State Cab. Nat. Hist., 1863, p. 19;—Pal. New York, IV, 1867, p. 5, pl. 2, fig. 1.

Loc. Clarkesville, New York.

Lingula cincinnatiensis Hall and Whitfield. Lorraine (Ord.).

Lingulella (Dignomia) cincinnatiensis Hall and Whitfield, Pal. Ohio, II, 1875, p. 67, pl. 1, figs. 2, 3.

Lingulella cincinnatiensis Miller, American Pal. Foss., 1877, p. 115.

Loc. Cincinnati, Ohio.

Lingula clathrata Winchell and Schuchert. Trenton (Ord.).

Lingula clathrata Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 345, pl. 29, fig. 42.

Loc. St. Paul, Minnesota.

Lingula clintoni Vanuxem. Clinton (Sil.).

Lingula oblonga Conrad (non Eichwald), Third Ann. Rep. Geol. Survey New York, 1839, p. 65.—Hall, Geol. New York; Rep. Fourth Dist., 1843, p. 77, fig. 4;—Pal. New York, II, 1852, p. 54, pl. 20, fig. 1.—Rogers, Geol. Pennsylvania, II, Pt. II, 1858, p. 823, fig. 629.

Lingula clintoni Vanuxem, Geol. New York; Rep. Third Dist., 1842, p. 79, fig. 4.

Lingula suboblonga d'Orbigny, Prodrome Pal. Stratig., 1850, p. 34.

Loc. Cayuga County, New York; Pennsylvania; Hamilton, Ontario; Arisaig, Nova Scotia (Honeyman and Ami).

Lingula cobourgensis Billings. Trenton (Ord.).

Lingula cobourgensis Billings, Pal. Fossils, I, 1862, p. 50, fig. 54;—Geol. Canada, 1863, p. 161, fig. 132.

Lingula cobourgensis? Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 346, pl. 29, fig. 12.

Loc. Cobourg and Colingwood, Canada; ?Minneapolis, Minnesota; in the Utica at Ottawa, Canada (Ami).

Lingula coheni A. Ulrich. Middle Devonian.

Lingula coheni A. Ulrich, N. Yahrb. f. Mineral., Beilageband, VIII, 1892, p. 82, pl. 5, fig. 11.

Loc. Near Pulquina, Bolivia.

Lingula complanata Williams. Hamilton-Ithaca (Dev.).

Lingula nuda Hall, Pal. New York, IV, 1867, pl. 2, fig. 4 (not figs. 5, 6).

Lingula complanata Williams, Proc. American Ass. Adv. Sci., XXX, 1882, p. 188;—Bull. U. S. Geol. Survey, 3, 1884, pp. 14, 15, 20, 22.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 1, fig. 17.

Loc. Ithaca and Canandaigua Lake, New York.

Lingula compta Hall and Clarke. Hamilton (Dev.).

Lingula compta Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 171, pl. 1, fig. 16.

Loc. Canandaigua Lake, New York.

Lingula concentrica Vanuxem=Schizobolus concentricus.

Lingula concentrica Conrad. ? Corniferous (Dev.).

Lingula concentrica Conrad, Third Ann. Rep. Geol. Survey New York, 1839, p 64.

Loc. "Helderberg Mountains," New York.

Obs. Insufficiently defined to be recognized.

Lingula covingtonensis Hall and Whitfield. Utica (Ord.).

Lingula covingtonensis Hall and Whitfield, Pal. Ohio, II, 1875, p. 67, pl. 1, fig. 1.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 8.

Loc. Covington, Kentucky.

Lingula crassa Hall=Glossina crassa.

Lingula crawfordsvillensis Gurley. Keokuk (L. Carb.).

Lingula crawfordsvillensis Gurley, New Carboniferous Foss., 1, 1883, p. 2.—Miller, N. American Geol. Pal., 1889, p. 350.

Loc. Crawfordsville, Indiana.

Obs. Should be compared with L. varsaviensis.

Lingula cuneata Conrad. Medina (Sil.).

Lingula cuneata Conrad, Third Ann. Rep. Geol. Survey New York, 1839, pp. 63, 64.—Hall, Geol. New York; Rep. Fourth Dist., 1843, p. 48, fig. 5;—Pal. New York, II, 1852, p. 8, pl. 4, fig. 2.—Hall and Clarke, Pal. New York, VIII Pt. I, 1892, p. 12, pl. 1, figs. 11, 12; pl. 4K, fig. 9.

Lingulella cuneata Miller, N. American Geol. Pal., 1889, p. 352.

Loc. Medina and Lockport, New York.

Lingula curta Conrad. Trenton-Utica (Ord.).

Lingula curta Conrad, Jour. Acad. Nat. Sci. Philadelphia, VIII, 1842, p. 266, pl. 15, fig. 12.—Hall, Pal. New York, I, 1847, p. 97, pl. 30, fig. 6.—Rogers, Geol. Pennsylvania, II, Pt. II, 1858, p. 818, fig. 604.—Billings, Geol. Canada, 1863, p. 161, fig. 138; p. 201, fig. 197.—Emerson, Geol. Frobischer Bay; Nourse's Narr. Hall's Arctic Exped., App., III, 1879, p. 578.

Loc. East Canada Creek and Middleville, New York; Carlisle, etc., Pennsylvania; Montmorency Falls, Canada; Frobischer Bay.

Lingula cuyahoga Hall. Chemung-Waverly (Dev.-L. Carb.).

Lingula cuyahoga Hall, Sixteenth Rep. New York State Cab. Nat. Hist., 1863, p. 24;—Pal. New York, IV, 1867, p. 15, pl. 1, fig. 5.—Herrick, Bull. Denison Univ., IV, 1888, p. 13;—Geol. Ohio, VII, 1895, pl. 22, fig. 9.

Lingula cuyahoga? Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 1, fig. 18.

Loc. Akron and Cuyahoga Falls, Ohio; Chemung group, Panama, New York.

Lingula cyane Billings=Glossina cyane.

Lingula daphne Billings=Glossina trentonensis.

Lingula dawsoni Matthew=Lingulella dawsoni.

Lingula delia Hall. Hamilton (Dev.).

Lingula delia Hall, Sixteenth Rep. New York State Cab. Nat. Hist., 1863, p. 22;—Pal. New York, IV, 1867, p. 12, pl. 2, fig. 9.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 15, pl. 1, fig. 29.

Loc. Canandaigua Lake, New York.

Lingula densa Hall. Hamilton (Dev.).

Lingula densa Hall, Sixteenth Rep. New York State Cab. Nat. Hist., 1863, p. 22;—Pal. New York, IV, 1867, p. 11, pl. 2, figs. 10, 11.

Lingula densa Hall—Continued.

Lingula densa? Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 15, pl. 1, fig. 23.

Loc. Summit and Centerfield, New York.

Lingula desiderata Hall. Corniferous (Dev.).

Lingula desiderata Hall, Sixteenth Rep. New York State Cab. Nat. Hist., 1863, p. 19;—Pal. New York, IV, 1867, p. 6, pl. 2, fig. 2.

Loc. Ontario County, New York.

Lingula(?) dolata Sardeson. Calciferous (Ord.).

Lingula dolata Sardeson, Bull. Minnesota Acad. Nat. Sci., IV, 1896, pl. 6, fig. 12.

Loc. Stillwater, Minnesota.

Lingula dubia d'Orbigny=Glossina dubia.

Lingula elderi Whitfield. Trenton and Lorraine (Ord.).

Lingula elderi Whitfield, American Jour. Sci., 3d ser., XIX, June, 1880, p. 472, figs. 1, 2;—Geol. Wisconsin, IV, 1882, p. 345, pl. 27, figs. 1–5.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 11, pl. 1, figs. 21, 22.—Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 339, pl. 29, figs. 1–4.

Lingula minnesotensis N. H. Winchell, Eighth Ann. Rep. Geol. Nat. Hist. Survey Minnesota, July, 1880, p. 61.

Loc. Rochester, Minneapolis, etc., Minnesota; Beloit, Wisconsin; Cincinnati, Ohio.

Lingula elegantula Shaler=L. rectilateralis.

Lingula elliptica Hall (non Phillips)=L. subelliptica.

Lingula(?) elliptica Emmons. Cambrian.

Lingula elliptica Emmons (non Phillips, 1836), American Geology, Pt. II, 1855, p. 112.

Loc. Augusta County, Virginia.

Obs. This species belongs to another genus. The specific name will therefore not conflict with that of Phillips.

Lingula elongata Hall. Trenton (Ord.).

Lingula elongata Hall, Pal. New York, I, 1847, p. 97, pl. 30, fig. 5.—Billings, Geol. Canada, 1863, p. 161, fig. 135.—Whiteaves, Pal. Foss., III, Pt. III, 1897, p. 165.

Loc. Lewis County, New York; Lake Winnipeg, Manitoba; Ottawa, Canada, in the Utica terrane (Ami).

Lingula ererensis Rathbun. Middle Devonian.

Lingula ererensis Rathbun, Proc. Boston Soc. Nat. Hist., XX, 1879, p. 16.

Loc. Erere, Province of Para, Brazil.

Lingula exilis Hall=Lingulodiscina exilis.

Lingula eva Billings. Black River (Ord.).

Lingula eva Billings, Canadian Nat. Geol., VI, 1861, p. 150;—Geol. Canada, 1863, p. 141, fig. 73.—Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 341, pl. 29, figs. 5, 6.

Loc. Murray Bay, Canada; Fremont, Winona County, Minnesota.

Lingula forbesi Billings. Lorraine (Ord.).

Lingula forbesi Billings, Pal. Fossils, I, 1862, p. 115, fig. 96.

Loc. Anticosti.

Lingula gannensis Herrick. Waverly (L. Carb.).

Lingula gannensis Herrick, Bull. Denison Univ., IV, 1888, pp. 12, 17, pl. 3, figs. 2, 3;—Geol. Ohio, VII, 1895, pl. 22, figs. 2, 3.

Loc. Gann, Knox County, Ohio.

Lingula gibbosa Hall. Niagara (Sil.).

Lingula gibbosa Hall, Description n. sp. Foss. Waldron, Indiana, 1879, p. 13;—Eleventh Rep. State Geol. Indiana, 1882, p. 284, pl. 27, fig. 2;—Trans. Albany Institute, X, 1883, p. 69.

Loc. Waldron, Indiana.

Lingula gorbyi Miller. Chouteau (L. Carb.).

Lingula gorbyi Miller, Eighteenth Ann. Rep. Geol. Survey Indiana, 1894, p. 309, pl. 9, figs. 3, 4.

Loc. Sedalia, Missouri.

Lingula gracana Rathbun. Middle Devonian.

Lingula gracana Rathbun, Bull. Buffalo Soc. Nat. Sci., I, 1874, p. 259, fig. 2.

Loc. Erere, Province of Para, Brazil.

Lingula halli White. Burlington (L. Carb.).

Lingula halli White, Proc. Boston Soc. Nat. Hist., IX, 1862, p. 30.

Loc. Burlington, Iowa.

Lingula howleyi Matthew. Lower Ordovician.

Lingula howleyi Matthew, Trans. Royal Soc. Canada, 2d ser., I, 1896, p. 259, pl. 1, fig. 3.

Loc. Kelleys Island, Conception Bay, Newfoundland.

Obs. Appears to be a synonym for L. murrayi Billings.

Lingula hurlbuti N. H. Winchell = Glossina hurlbuti.

Lingula huronensis Billings. Chazy (Ord.).

Lingula huronensis Billings, Canadian Nat. Geol., IV, 1859, p. 433, fig. 9;—Geol. Canada, 1863, p. 124, fig. 48.

Loc. St. Joseph Island, Lake Huron.

Lingula indianaensis Miller and Gurley. Keokuk (L. Carb.).

Lingula indianensis Miller and Gurley, Bull. Illinois State Mus. Nat. Hist., 3, 1893, p. 69, pl. 7, fig. 1.

Loc. Crawfordsville, Indiana.

Lingula ingens Spencer. Niagara (Sil.).

Lingula ingens Spencer, Bull. Univ. State Missouri, 1884, p. 56;—Trans. St. Louis Acad. Sci., IV, 1886, p. 606, pl. 8, fig. 6.

Loc. Hamilton, Ontario.

Lingula insularis Billings. Anticosti (Sil.).

Lingula insularis Billings, Catalogue Sil. Foss. Anticosti, 1866, p. 40.

Loc. Anticosti.

Lingula iole Billings. Calciferous (Ord.).

Lingula iole Billings, Pal. Fossils, I, 1865, p. 215, fig. 199.

Loc. Near Portland Creek, Newfoundland.

Lingula iowaensis Owen. Galena (Ord.).

Lingula iowensis Owen, Geol. Rep. Iowa, Wisconsin, and Illinois, 1844, p. 70, pl. 15, fig. 1.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 8, pl. 1, fig. 14.—Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 349, pl. 29, figs. 19–22.—Whiteaves, Pal. Foss., III, Pt. III, 1897, p. 164.

Lingula quadrata? Owen (not Eich.), Geol. Rep. Wisconsin, Iowa, and Minnesota, 1851, pl. 2B, fig. 8. [See specimens in U. S. Nat. Mus., Cat. Invert. Foss., 17873.]

Lingula quadrata Hall, Geol. Wisconsin, I, 1862, p. 46, fig. 1, and p. 435.—Meek and Worthen, Geol. Survey Illinois, III, 1868, p. 305, pl. 2, fig. 4.

Lingulella iowensis Whitfield, Geol. Wisconsin, IV, 1882, p. 242, pl. 9, fig. 1.

Loc. Wisconsin; Iowa; Minnesota; Illinois; Lake Winnipeg, Manitoba.

Lingula irene Billings=Lingulella irene.

Lingula iris Billings. Calciferous (Ord.).

Lingula iris Billings, Pal. Fossils, I, 1865, p. 301, fig. 290.

Loc. Point Levis, Canada.

Lingula kingstonensis Billings. Black River (Ord.).

Lingula kingstonensis Billings, Pal. Fossils, I, 1862, p. 48, fig. 51;—Geol. Canada, 1863, p. 141, fig. 74.

Loc. Long Island, near Kingston, Canada.

Lingula lamellata Hall, 1852 (partim, non Hall, 1843)=L. tæniola.

Lingula lamellata Hall. Niagara (Sil.).

Lingula lamellata Hall, Geol. New York; Rep. Fourth Dist., 1843, p. 108, fig. 2;—Pal. New York, II, 1852, p. 249, pl. 53, figs. 1, 2 (non p. 55, pl. 20, fig. 4=L. tæniola).—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 16, pl. 1, figs. 9, 10; pl. 4K, figs. 10–13.

Loc. Lockport and Rochester, New York; Hamilton, Ontario.

Lingula leana Hall=Glossina leana.

Lingula ligea Hall. Hamilton–Portage (Dev.).

Lingula ligea Hall, Thirteenth Rep. New York State Cab. Nat. Hist., 1860, p. 76;—Pal. New York, IV, 1867, p. 7, pl. 1, fig. 2.—Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 107, pl. 2, fig. 2.—Clarke, Bull. U. S. Geol. Survey, 16, 1885, p. 62.

Lingula ligea var. Hall, Pal. New York, IV, 1867, p. 8, pl. 2, fig. 8.

Lingula ligea? Whitfield, Annals New York Acad. Sci., V, 1891, pp. 547, 573, pl. 11, figs. 3, 4;—Geol. Ohio, VII, 1895, p. 441, pl. 7, figs. 3, 4; p. 462.

Loc. Seneca Lake, Ithaca, etc., New York; Thedford, Ontario (Whiteaves); Delaware County, Ohio (Whitfield); Eureka district, Nevada.

Lingula ligea nevadaensis Walcott. Lower Devonian.

Lingula ligea var. nevadensis Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 107, pl. 2, fig. 3.

Loc. Eureka district, Nevada.

Lingula lingulata Hall and Clarke. Clinton (Sil.).

Lingula lingulata Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 173, pl. 4K, fig. 5.

Loc. Hamilton, Ontario.

Lingula lonensis Walcott. Lower Devonian.

Lingula lonensis Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 108, pl. 13, fig. 1.

Loc. Lone Mountain, Nevada.

Lingula lucretia Billings. Gaspé No. 5 (Dev.).

Lingula lucretia Billings, Pal. Fossils, II, 1874, p. 14, fig. 3.

Loc. Cape Bon Ami, Gaspé.

Lingula lyelli Billings. Chazy (Ord.).

Lingula lyelli Billings, Canadian Nat. Geol., IV, 1859, p. 348, fig. 1; p. 431;—Geol. Canada, 1863, p. 124, fig. 49.

Loc. Alumette Island.

Lingula maida Hall. Hamilton (Dev.).

Lingula maida Hall, Sixteenth Rep. New York State Cab. Nat. Hist., 1863, p. 20;—Pal. New York, IV, 1867, p. 9, pl. 2, fig. 13.

Loc. Moscow, New York.

Lingula manni Hall. Corniferous (Dev.).

Lingula manni Hall, Sixteenth Rep. New York State Cab. Nat. Hist., 1863, p. 20;—Pal. New York, IV, 1867, p. 6, pl. 2, fig. 3.—Whitfield, Annals New York Acad. Sci., V, 1891, p. 546, pl. 11, figs. 1, 2;—Geol. Ohio, VII, 1895, p. 441, pl. 7, figs. 1, 2.

Loc. Delaware County, Ohio.

Lingula mantelli Billings. Calciferous (Ord.).

Lingula mantelli Billings, Canadian Nat. Geol., IV, 1859, p. 349, figs. 1e-1f;—Geol. Canada, 1863, p. 113, fig. 20.

Loc. St. Eustache, Canada.

Lingula (?) manticula White. Upper Cambrian.

Lingula? manticula White, Wheeler's Expl. Survey west 100 Merid., Prel. Rep., 1874, p. 9;—Ibidem, Final Rep., IV, 1875, p. 52, pl. 3, fig. 2.—Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 13, pl. 9, fig. 3; pl. 11, fig. 2.

Loc. Schell Creek Range, Nevada.

Lingula marginata d'Orbigny (non Phillips)=L. submarginata.

Lingula matthewi Hartt=Acrothele matthewi.

Lingula meeki Herrick. Waverly (L. Carb.).

Lingula meeki Herrick, Bull. Denison Univ., IV, 1888, pp. 13, 18, pl. 10, fig. 31;—Geol. Ohio, VII, 1895, pl. 22, figs. 7, 8.

Loc. Cuyahoga Valley, Ohio.

Lingula melie Hall. Waverly (L. Carb.).

Lingula melie Hall, Sixteenth Rep. New York State Cab. Nat. Hist., 1863, p. 24;—Pal. New York, IV, 1867, p. 14, pl. 1, figs. 3, 4.—Meek, Pal. Ohio, II, 1875, p. 276, pl. 14, fig. 3.—Herrick, Bull. Denison Univ., IV, 1888, p. 13.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 12, fig. 9; pl. 1, fig. 32.—Herrick, Geol. Ohio, VII, 1895, pl. 20, fig. 1; pl. 22, fig. 10.

Loc. Chagrin Falls and Berea, Ohio.

Lingula membranacea Winchell. Waverly (L. Carb.).

Lingula membranacea A. Winchell, Proc. Acad. Nat. Sci. Philadelphia, 1863, p. 3.—Herrick, Bull. Denison Univ., IV, 1888, pp. 12, 17, pl. 3, fig. 4;—Geol. Ohio, VII, 1895, pl. 22, fig. 4.

Lingula (Lingulella?) membranacea Meek, Pal. Ohio, II, 1875, p. 275, pl. 14, fig. 4.

Loc. Burlington, Iowa; Harts Grove and Loudonville, Ohio; Shafers, Pennsylvania.

Lingula metensis Terquem? Lower Lias (Jurassic).

Lingula cf. metensis (Terquem) Möricke, Neues Jahrbuch f. Mineral., Beilageband, IX, 1894, p. 58, pl. 5, fig. 10.

Loc. Sierra de la Ternera; Mine Amolanes, Chile.

Lingula minnesotensis N. H. Winchell=L. elderi.

Lingula minuta Meek. Hamilton (Dev.).

Lingula minuta Meek, Trans. Chicago Acad. Sci., I, 1868, p. 87, pl. 13, fig. 1.

Loc. Near Fort Resolution, Great Slave Lake, British America.

Lingula modesta E. O. Ulrich. Trenton-Lorraine (Ord.).

Lingula modesta Ulrich, American Geologist, III, 1889, p. 382, fig. 4 on p. 378.—Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 344, pl. 29, fig. 41.

Lingula vanhorni Hall and Clarke (non Miller), Pal. New York, VIII, Pt. I, 1892, pl. 1, fig. 4.

Loc. Covington and Frankfort, Kentucky; Lattners, Iowa; Granger and Wykoff, Minnesota.

Lingula morsei (N. H. Winchell). St. Peters (Ord.).

Lingulepis morsensis N. H. Winchell, Fourth Ann. Rep. Geol. Nat. Hist. Survey Minnesota, 1876, p. 41, fig. 6.

Lingulepis morsii Miller, N. American Geol. Pal., 1889, p. 352.

Lingula morsii Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 62.—Sardeson, Bull. Minnesota Acad. Nat. Sci., IV, 1896, p. 77, pl. 4, figs. 2, 3.

Loc. Near Fountain, Minnesota.

Lingula mosia Hall. Upper Cambrian.

Lingula mosia Hall, Sixteenth Rep. New York State Cab. Nat. Hist., 1863, p. 126, pl. 6, figs. 1-3;—Trans. Albany Institute, V, 1867, p. 102.—Sardeson, Bull. Minnesota Acad. Nat. Sci., IV, 1896, p. 95.

Loc. Lagrange Mountain, Minnesota; Mazomanie, Wisconsin.

Lingula münsteri d'Orbigny. Ordovician.

Lingula münsterii d'Orbigny, Voyage dans l'Amérique Méridionale, Pal., 1842, p. 29, pl. 2, fig. 6.

Lingula münsteri A. Ulrich, N. Jahrb. f. Mineral., Beilageband, VIII, 1892, p. 7.

Loc. Tacopaya, etc., Bolivia.

Lingula(?) murrayi Billings. Upper Cambrian.

Lingula murrayi Billings, Canadian Nat. Geol., n. ser., VI, 1872, p. 467, fig. 3;—Pal. Fossils, II, 1874, p. 66, fig. 34.

Loc. Bell Island, Conception Bay, Newfoundland.

Obs. See Lingula howleyi.

Lingula mytiloides Sowerby. Upper Carboniferous.

Lingula mytiloides Sowerby, Mineral Conchology, I, 1813, p. 55, tab. 19, figs. 1, 2.—Meek and Worthen, Geol. Survey Illinois, V, 1873, p. 572, pl. 25, fig. 2.

Loc. Illinois.

Lingula nitida Meek and Hayden. Upper Cretaceous.

Lingula nitida Meek and Hayden, Proc. Acad. Nat. Sci. Philadelphia, 1861, p. 443.—Meek, Rep. U. S. Geol. Survey Terr., IX, 1876, p. 9, pl. 28, fig. 18.—White, Eleventh Rep. U. S. Geol. Survey Terr., 1879, p. 205.—Whiteaves, Cont. Canadian Pal., I, 1885, p. 29.

Loc. Mouth of Big Horn River, Nebraska; Sage Creek, Colorado; Near Irvine Station, Canadian Pacific Railroad, Canada.

Lingula norwoodi James=Lingulops norwoodi.

Lingula nuda Hall (partim)=L. complanata.

Lingula nuda Hall. Hamilton (Dev.).

Lingula nuda Hall, Sixteenth Rep. New York State Cab. Nat. Hist., 1863, p. 22;—Pal. New York, IV, 1867, p. 10, pl. 2, figs. 5, 6 (non fig. 4=L. complanata).

Loc. Canandaigua Lake, New York.

Lingula nympha Billings. Calciferous (Ord.).

Lingula nympha Billings, Pal. Fossils, I, 1865, p. 214, fig. 198.

Loc. Table Head, Newfoundland.

Lingula oblata Hall. Clinton (Sil.).

Lingula oblata Hall, Geol. New York; Rep. Fourth Dist., 1843, p. 77, fig. 8 on p. 76;—Pal. New York, II, 1852, p. 54, pl. 20, fig. 2.

Loc. Sodus and Wolcott, New York.

Lingula oblonga Conrad (non Eichwald)=L. clintoni.

Lingula obtusa Hall. Trenton-Utica (Ord.).

Lingula obtusa Hall, Pal. New York, I, 1847, p. 98, pl. 30, fig. 7.—Billings, Geol. Canada, 1863, p. 161, fig. 137.—Whiteaves, Pal. Foss., III, Pt. III, 1897, p. 165.

Loc. Middleville, New York; Lake Winnipeg and Ottawa, Canada.

Lingula paliformis Hall=Lingulella paliformis.

Lingula papillosa Emmons. Trenton (Ord.).

Lingula papillosa Emmons, American Geology, Pt. II, 1855, p. 202, fig. 64;—Manual Geol., 1860, p. 99, fig. in text.

Loc. Unknown.

Lingula paracletus Hall and Clarke. Waverly (L. Carb.).

Lingula paracletus Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 10, 12, fig. 8; p. 172.

Loc. Chardon, Ohio.

Lingula parrishi Miller. Upper Carboniferous.

Lingula parrishi Miller, Eighteenth Ann. Rep. Geol. Survey Indiana, 1894, p. 307, pl. 8, fig. 2; pl. 9, fig. 1.

Loc. Kansas City, Missouri.

Lingula perlata Hall. Lower Helderberg (Dev.).

Lingula perlata Hall, Pal. New York, III, 1859, p. 156, pl. 9, figs. 3–5.

Loc. Albany and Schoharie counties, New York.

Lingula perovata Hall=Glossina perovata.

Lingula perplexa Hall=L. subelliptica.

Lingula perryi Billings. ? Chazy (Ord.).

Lingula perryi Billings, Pal. Fossils, I, 1861, p. 20, fig. 23;—Geol. Vermont, II, 1861, p. 957, fig. 363;—Geol. Canada, 1863, p. 274, fig. 278.

Loc. Highgate Spring, Vermont.

Lingula philomela Billings. Trenton and Lorraine (Ord.).

Lingula philomela Billings, Pal. Fossils, I, 1862, p. 49, fig. 53;—Geol. Canada, 1863, p. 161, fig. 133.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 1, fig. 8.—Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 342, pl. 29, figs. 7, 8.

Loc. Montmorency Falls, Ottawa, etc., Canada; Florenceville, Iowa.

Lingula plagemanni Möricke. Jurassic.

Lingula plagemanni Möricke, Neues Jahrbuch f. Mineral., Beilageband, IX, 1894, p. 59, pl. 5, fig. 9.

Loc. Canales and Caracoles, Bolivia.

Lingula pinnaformis Hall = Lingulepis pinniformis.

Lingula polita Hall=Obolella polita.

Lingula prima Hall=Lingulepis prima.

Lingula procteri Ulrich=L. vanhorni.

Lingula progne Billings. Trenton-Utica (Ord.).

Lingula progne Billings, Pal. Fossils, I, 1862, p. 47, fig. 50;—Geol. Canada, 1863, p. 161, fig. 134; p. 201, fig. 196.

Loc. Montreal, Collingwood, Ottawa, etc., Canada.

Lingula punctata Hall. Hamilton and Ithaca (Dev.).

Lingula punctata Hall, Sixteenth Rep. New York State Cab. Nat. Hist., 1863, p. 21;—Pal. New York, IV, 1867, p. 10, pl. 1, fig. 6.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 11, 17, pl. 1, figs. 26–28.

Loc. Canandaigua Lake and Summit, New York; Portage group at Ithaca (Williams).

Lingula quadrata, American authors=L. rectilateralis and L. iowaensis.

Lingula quebecensis Billings. Upper Cambrian and Calciferous.

Lingula quebecensis Billings, Pal. Fossils, I, 1862, p. 72, fig. 65; pp. 72, 216;—Geol. Canada, 1863, p. 230, fig. 241.

Loc. Point Levis, Sillery, etc., Canada; Cow Head, Newfoundland.

Lingula rectilatera Hall. Lower Helderberg (Dev.).

Lingula rectilatera Hall, Pal. New York, III, 1859, p. 156, pl. 9, figs 6–8.

Loc. Albany and Schoharie counties, New York; Arisaig, Nova Scotia (Ami).

Lingula rectilateralis Emmons. Trenton-Lorraine (Ord.).

Lingula rectilateralis Emmons, Geol. New York; Rep. Second Dist., 1842, p. 399, fig. 6.

Lingula quadrata Hall (non Eichwald), Pal. New York, I, 1847, p. 96, pl. 30, fig. 4; p. 285, pl. 79, fig. 1.—Billings, Canadian Nat. Geol., I, 1856, p. 319, fig. 8.—Rogers, Geol. Pennsylvania, II, Pt. II, 1858, p. 820, fig. 615.—Billings, Geol. Canada, 1863, p. 161, fig. 131;—Catalogue Sil. Foss. Anticosti, 1866, p. 10.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 1, fig. 13.

Lingula elegantula Shaler, Bull. Mus. Comp. Zool., 4, 1865, p. 61.

†Lingula quadrata Miller, Cincinnati Quart. Jour Sci., II, 1875, p. 9.

Loc. Rodman, Lorraine, Middleville, Trenton Falls, etc., New York; Ottawa etc., Canada; Anticosti.

Obs. This species is more closely related to L. iowaensis than to L. quadrata Eichwald.

Lingula riciniformis Hall. Trenton (Ord.).

Lingula riciniformis Hall, Pal. New York, I, 1847, p. 95, pl. 30, fig. 2.—Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 343, fig. 24; pl. 29, fig 9.

Lingula (Glossina) riciniformis Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 1, fig. 3.

Loc. Middleville, New York; Charlesbourg, Canada; St. Paul, Minnesota.

Lingula riciniformis galenaensis Winchell and Schuchert. Trenton (Ord.).

Lingula riciniformis var. galenensis Winchell and Schuchert, American Geol., IX, 1892, p. 284;—Minnesota Geol. Survey, III, 1893, p. 344, pl. 29, figs. 10, 11.

Loc. Near Kenyon and Fountain, Minnesota; Neenah and Oshkosh, Wisconsin.

Lingula rodriguezii Rathbun. Middle Devonian.

Lingula rodriguezii Rathbun, Bull. Buffalo Soc. Nat. Sci., I, 1874, p. 260.

Loc. Erere, Province of Para, Brazil.

Lingula scotica Meek (non Davidson)=Glossina waverlyensis.

Lingula scotica var. nebraskensis Meek=Glossina nebraskensis.

Lingula scutella Hall and Clarke. Chemung (Dev.).

Lingula scutella Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 171, pl. 1, fig. 30.

Loc. Alleghany County, New York.

Lingula shumardi Cragin. Lower Cretaceous.

Lingula shumardi Cragin, Geol. Survey Texas; Fourth Ann. Rep., 1893, p. 166.

Loc. Bonham-Sherman road, Fannin County, Texas.

Lingula spathata Hall. Lower Helderberg (Dev.).

Lingula spathata Hall, Pal. New York, III, 1859, p. 157, pl. 9, figs. 7, 9, 11.

Loc. Albany and Schoharie counties, New York; Arisaig, Nova Scotia (Ami).

Lingula spatiosa Hall=Glossina spatiosa.

Lingula spatulata Vanuxem. Genesee and Portage (Dev.).

Lingula spatulata Vanuxem, Geol. New York; Rep. Third Dist., 1842, p. 168, fig. 3.—Hall, Ibidem, Rep. Fourth Dist., 1843, p. 223, fig. 3;—Pal. New York, IV, 1867, p. 13, pl. 1, fig. 1.—Clarke, Bull. U. S. Geol. Survey, 16, 1885, p. 25.—

Lingula spatulata Vanuxem—Continued.

Tschernyschew, Mémoires du Comité Géologique de St. Pétersbourg, 1887, p. 116, pl. 14, fig. 29.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 1, fig. 15.

Lingula spatulata? Rathbun, Bull. Buffalo Soc. Nat. Sci., I, 1874, p. 258, fig. 1;—Proc. Boston Soc. Nat. Hist., XX, 1879, p. 16.

Loc. Lodi, Seneca Lake, etc., New York; Portage group at Ithaca, New York (Williams); Erere, Province of Para, Brazil; Urals of Russia.

Lingula stantoniana Rathbun. Middle Devonian.

Lingula stantoniana Rathbun, Bull. Buffalo Soc. Nat. Sci., I, 1874, p. 259, fig. 3.

Loc. Erere, Province of Para, Brazil.

Lingula(?) striata Emmons. Cambrian.

Lingula striata Emmons, American Geology, Pt. II, 1855, p. 112, pl. 1, fig. 17;—Manual Geol., 1860, p. 88, fig. 74.

Loc. Augusta County, Virginia.

Lingula subelliptica d'Orbigny. Clinton (Sil.).

Lingula elliptica Hall (non Phillips), Geol. New York; Rep. Fourth Dist., 1843, p. 76, fig. 7.

Lingula subelliptica d'Orbigny, Prodrome de Pal., I, 1850, p. 34.

Lingula perplexa Hall, Miller's American Pal. Fossils, 1877, p. 244.

Loc. Wolcott, New York.

Lingula submarginata d'Orbigny. Ordovician.

Lingula marginata d'Orbigny, Voyage dans l'Amérique Méridionale, Pal., 1842, p. 28, pl. 2, fig. 5.

Lingula submarginata d'Orbigny, Prodrome de Pal., I, 1850, p. 14.

Loc. Tacopaya, Bolivia.

Lingula suboblonga d'Orbigny=L. clintoni.

Lingula subspatulata Meek and Worthen (non Hall and Meek)=Barroisella subspatulata.

Lingula subspatulata Hall and Meek. Upper Cretaceous.

Lingula subspatulata Hall and Meek, Mem. American Acad. Arts Science, n. ser., V, 1854–1856, p. 380, pl. 1, fig. 2.—White, Rep. Geogr. Geol. Survey west 100th Merid., IV, 1875, p. 169, pl. 15, fig. 4.

Lingula subspatulata? Whiteaves, Cont. Canadian Pal., I, 1889, p. 185.

Loc. Near Red Cedar Island, Nebraska; near old Fort Wingate, New Mexico; Rolling River, Manitoba.

Lingula tæniola Hall and Clarke. Clinton (Sil.).

Lingula lamellata Hall (partim), Pal. New York, II, 1852, p. 55, pl. 20, fig. 4.

Lingula tæniola Hall and Clarke, Ibidem, VIII, Pt. I, 1892, pp. 18, 173, pl. 4K, fig. 8.

Loc. Clinton, New York; Hamilton, Ontario.

Lingula thedfordensis Whiteaves. Hamilton (Dev.).

Lingula thedfordensis Whiteaves, Extract Cont. Canadian Pal., I, 1887, p. 3, pl. 15, fig. 1;—Cont. Canadian Pal., I, 1889, p. 111, pl. 15, fig. 1.

Loc. Thedford, Ontario.

Lingula tighti Herrick. Upper Carboniferous.

Lingula tighti Herrick, Bull. Denison Univ., II, 1887, p. 43, pl. 4, fig. 5.

Loc. Newark, Ohio.

Lingula trentonensis Conrad=Glossina trentonensis.

Lingula triangulata Nettelroth=Glossina triangulata.

Lingula triquetra Clarke. Portage (Dev.).

Lingula triquetra Clarke, Bull. U. S. Geol. Survey, 16, 1885, p. 62, pl. 3, fig. 11.
Loc. Ontario County, New York.

Lingula truncata Sowerby. Neocomian (Cret.).

Lingula truncata Sowerby, Trans. Geol. Soc. London, IV, 1836, pl. 14, fig. 15.—Davidson, British Cret. Brach., Pal. Soc., 1852, p. 6, pl. 1, figs. 27, 28, 31.—Behrendsen, Zeit. der Deutschen Geol. Gessel., XLIV, 1892, p. 27.
Loc. Europe; Arrogo, Trinquico, Argentine Republic.

Lingula umbonata Cox. Upper Carboniferous.

Lingula umbonata Cox, Owen's Geol. Survey Kentucky, III, 1857, p. 576, pl. 10, fig. 4.—White, Thirteenth Rep. State Geol. Indiana, 1884, p. 120, pl. 25, fig. 14.—Herrick, Bull. Denison Univ., II, 1887, p. 144, pl. 14, fig. 2.—Keyes, Proc. Acad. Nat. Sci. Philadelphia, 1888, p. 226;—Geol. Survey Missouri, V, 1895, p. 38, pl. 35, fig. 4.
Loc. Crittenden, Union, and Hancock counties, Kentucky; Newark, Ohio; Des Moines, Iowa; Clinton and Kansas City, Missouri.

Lingula vanhorni Hall and Clarke (partim)=L. modesta.

Lingula vanhorni Miller. Trenton and Lorraine (Ord.).

Lingula vanhorni Miller, Cincinnati Quart. Jour. Sci., II, 1875, p. 9, fig. 1;—Eighteenth Rep. Geol. Survey Indiana, 1894, p. 309.
Lingula procteri Ulrich, American Geologist, III, 1889, p. 377, fig. 1.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 12, pl. 1, figs. 5–7.
Loc. Versailles, Indiana; Covington and Burgin, Kentucky.
Obs. An examination of the type specimen led to the above synonymy.

Lingula varsaviensis Worthen. Warsaw (L. Carb.).

Lingula varsoviense Worthen, Bull. Illinois State Mus. Nat. Hist., 2, 1884, p. 24;—Geol. Survey Illinois, VIII, 1890, p. 104, pl. 11, fig. 8.
Loc. Warsaw and Hamilton, Illinois.

Lingula waverlyensis Herrick=Glossina waverlyensis.

Lingula whitfieldi Ulrich. Lorraine (Ord.).

Lingula whitfieldi Ulrich, American Geologist, III, 1889, p. 381, fig. 3 on p. 378.
Loc. Covington, Kentucky.

Lingula whitei Walcott. Lower Devonian.

Lingula whitii Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 109, pl. 13, fig. 3.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 11, pl. 1, fig. 31.
Loc. Eureka district, Nevada.

Lingula winona Hall=Lingulella winona.

LINGULASMA E. O. Ulrich. Genotype L. schucherti Ulrich.

Lingulasma Ulrich, American Geologist, III, 1889. p. 383.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 24, 46, 163.—Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 353.—Hall and Clarke, Eleventh Ann. Rep. New York State Geologist, 1894, p. 335.
Lingulelasma Miller, N. American Geol. Pal., 1889, p. 351.

Lingulasma galenaense Winchell and Schuchert. Galena (Ord.).

Lingulasma galenensis Winchell and Schuchert, American Geol., IX, 1892, p. 285;—Minnesota Geol. Survey, III, 1893, p. 354, pl. 30, figs. 1–4.
Loc. Fillmore and Goodhue counties, Minnesota; Decorah, Iowa; Neenah and Oshkosh, Wisconsin.

Lingulasma schucherti Ulrich. Lorraine (Ord.).

Lingulasma schucherti Ulrich, American Geologist, III, 1889, p. 389, fig. 5 on p. 378.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 24, pl. 2, figs. 17–23.

Lingulelasma schucherti Miller, N. American Geol. Pal., 1889, p. 351.

Loc. Wilmington and Savanna, Illinois.

LINGULELLA Salter. Genotype Lingula davisi McCoy.

Lingulella Salter, Mem. Geol. Survey Great Britain, III, 1866, p. 333.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 55, 163;—Eleventh Ann. Rep. New York State Geologist, 1894, p. 232.

Lingulella affinis Billings=Lingulobolus affinis.

Lingulella ampla (Owen). Middle Cambrian.

Lingula ampla Owen, Geol. Rep. Wisconsin, Iowa, and Minnesota, 1852, p. 583, pl. 1B, fig. 5.—Hall, Sixteenth Rep. New York State Cab. Nat. Hist., 1863, p. 125, pl. 6, fig. 10;—Trans. Albany Institute, V, 1867, p. 101.

Loc. Trempealeau, Wisconsin; Winona, Minnesota.

Lingulella aurora Hall. Upper Cambrian.

Lingula aurora Hall, Ann. Geol. Rep. Wisconsin, 1861, p. 24;—Geol. Surv. Wisconsin, I, 1862, p. 21, fig. 4; p. 435;—Sixteenth Rep. New York State Cab. Nat. Hist., 1863, p. 126, pl. 6, figs. 4, 5;—Trans. Albany Institute, V, 1867, p. 103.

Lingulella aurora Hall, Twenty-third Rep. New York State Cab. Nat. Hist., 1873, p. 244.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 2, figs. 12, 13.

Loc. Mazomanie, Wisconsin; Osceola, Wisconsin, and Otisville, Minnesota (Sardeson).

Lingulella(?) billingsana (Whiteaves). Upper Cambrian.

Lingula billingsana Whiteaves, American Jour. Sci., 3d ser., XVI, 1878, p. 226.

Lingula cfr. billingsiana Matthew, Trans. Royal Soc. Canada, X, 1894, p. 93, pl. 16, fig. 6.

Loc. Conception Bay, Newfoundland.

Lingulella cælata (Hall). Lower Cambrian.

Orbicula cælata Hall, Pal. New York, I, 1847, p. 290, pl. 79, fig. 9.

Obolella cælata Billings, Canadian Nat. Geol., 2d ser., VI, 1871, p. 218.

Obolella (Obolus) cælata Ford, American Jour. Sci., 3d ser., II, 1871, p. 33.

Lingulella cælata Ford, Ibidem, XV, 1878, p. 127.—Walcott, Bull. U. S. Geol. Survey, 30, 1886, p. 95, pl. 7, fig. 1;—Tenth Ann. Rep. U. S. Geol. Survey, 1891, p. 607, pl. 67, fig. 1.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 57, pl. 2, figs. 1–4.

Lingula ? cælata Matthew, Trans. New York Acad. Sci., XIV, 1895, p. 126.

Loc. Troy and Schodack Landing, New York; New Brunswick.

Lingulella cincinnatiensis Hall and Whitfield=Lingula cincinnatiensis.

Lingulella(?) cuneata Matthew. Lowest Ordovician.

Lingulella(?) cuneata Matthew, Trans. Royal Soc. Canada, X, 1894, p 92, pl. 16, fig. 5.

Loc. Hardingville, New Brunswick.

Lingulella dawsoni Matthew. Middle Cambrian.

Lingula? dawsoni (Matthew MS.) Walcott, Bull. U. S. Geol. Survey, 10, 1884, p. 15, pl. 5, fig. 8.

Lingulella dawsoni Matthew, Trans. Royal Soc. Canada, III, 1886, p. 33, pl. 5, fig. 9.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 58, pl. 2, fig. 5.

Loc. Portland, etc., New Brunswick.

Lingulella ella (Hall and Whitfield). Lower and Middle Cambrian.

Lingulepis ella Hall and Whitfield, King's U. S. Geol. Expl. 40th Parl., IV, 1877, p. 232, pl. 1, fig. 8.

Lingulella ella Walcott, Bull. U. S. Geol. Survey, 30, 1886, p. 97, pl. 7, fig. 2; pl. 8, fig. 4;—Tenth Ann. Rep. U. S. Geol. Survey, 1891, p. 607, pl. 67, fig. 2.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 58, figs. 19–21.

Loc. Wasatch Range, Utah; near Pioche, Nevada.

Lingulella granvillensis Walcott. Lower Cambrian.

Lingulella granvillensis Walcott, American Jour. Sci., 3d ser., XXXIV, 1887, p. 188, pl. 1, fig. 15;—Tenth Ann. Rep. U. S. Geol. Survey, 1891, p. 607, pl. 67, fig. 4.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 58.

Lingulella cfr. granvillensis Matthew, Trans. New York Acad. Sci., XIV, 1895, p. 114.

Loc. North Granville, New York; ?New Brunswick.

Lingulella(?) inflata Matthew. Middle Cambrian.

Lingulella? inflata Matthew, Trans. Royal Soc. Canada, III, 1886, p. 33, pl. 5, fig. 7;—Trans. New York Acad. Sci., XIV, 1895, p. 127, pl. 5, fig. 3.

Loc. Hanford Brook, St. Martins, New Brunswick.

Lingulella inflata ovalis Matthew. ?Middle Cambrian.

Lingulella inflata var. ovalis Matthew, Trans. New York Acad. Sci., XIV, 1895, p. 127, pl. 5, fig. 4.

Loc. Hanford Brook, New Brunswick.

Lingulella irene (Billings). Upper Cambrian and Calciferous.

Lingula irene Billings, Pal. Fossils, I, 1862, p. 71, fig. 64;—Geol. Canada, 1863, p. 230, fig. 240.

Loc. Point Levis, Canada.

Lingulella lævis Matthew. Upper Cambrian.

Lingulella lævis Matthew, Trans. Royal Soc. Canada, IX, 1892, p. 39, pl. 12, figs. 4a, 4b.

Loc. Near St. John, New Brunswick.

Lingulella lamborni Meek. ?Upper Cambrian.

Lingulella lamborni Meek, Proc. Acad. Nat. Sci. Philadelphia, 1871, p. 185, fig. 1.—Keyes, Geol. Survey Missouri, V, 1895, p. 38, pl. 35, fig. 5.

Loc. Madison County, Missouri.

Lingulella linguloides Matthew. Middle Cambrian.

Lingulella linguloides Matthew, Trans. Royal Soc. Canada, III, 1886, p. 34, pl. 5, fig. 8.

Loc. Porters Brook, St. Martins, New Brunswick.

Lingulella macconelli Walcott. Middle Cambrian.

Lingulella macconelli Walcott, Proc. U. S. Nat. Museum, XI, 1888, p. 441.

Loc. Mt. Stephens, British Columbia.

Lingulella martinensis Matthew. Middle Cambrian.

Lingulella martinensis Matthew, Trans. Royal Soc. Canada, IV, 1890, p. 155, pl. 8, fig. 4;—Trans. New York Acad. Sci., XIV, 1895, p. 113, pl. 2, fig. 6.

Loc. Hanford Brook, New Brunswick.

Lingulella minuta Hall and Whitfield. Up. Camb. and Pogonip (Ord.).

Lingulella? minuta Hall and Whitfield, King's U. S. Geol. Expl. 40th Parl., IV, 1877, p. 206, pl. 1, figs. 3, 4.—Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 13.

Loc. Eureka district, Nevada.

Lingulella(?) paliformis Hall. Hamilton (Dev.).

Lingula paliformis Hall, Thirteenth Rep. New York State Cab. Nat. Hist., 1860, p. 76, fig. 1.

Lingula palæformis Hall, Pal. New York, IV, 1867, p. 8, pl. 1, fig. 7.—Whitfield, Geol. Wisconsin, IV, 1882, p. 324, pl. 25, fig. 10.

Lingulella? palæformis Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 59, 64, pl. 2, figs. 6–8.

Loc. Cayuga Lake, New York; Milwaukee, Wisconsin.

Lingulella radula Matthew. Middle Cambrian.

Lingulella radula Matthew, Trans. Royal Soc. Canada, VIII, 1891, p. 147, pl. 15, figs. 7, 8.

Loc. St. John, New Brunswick.

Lingulella roberti Matthew. Lower Ordovician.

Lingulella roberti Matthew, Trans. Royal Soc. Canada, 2d ser., I, 1896, p. 256, pl. 1, fig. 2.

Loc. Cape Breton, Nova Scotia.

Lingulella selwyni Matthew. Lower Ordovician.

Lingulella selwyni Matthew, Trans. Royal Soc. Canada, 2d ser., I, 1896, p. 255, pl. 1, fig. 1.

Loc. Cape Breton, Nova Scotia.

Lingulella? spissa=Sphærobolus spissus.

Lingulella starri Matthew. Middle Cambrian.

Lingulella starri Matthew, Trans. Royal Soc. Canada, VIII, 1891, p. 146, pl. 15, figs. 5, 6.

Loc. St. Johns, New Brunswick.

Lingulella starri minor Matthew. Upper Cambrian.

Lingulella starri var. minor Matthew, Trans. Royal Soc. Canada, IX, 1892, p. 58.

Loc. Near St. John, New Brunswick.

Lingulella stoneana Whitfield. Upper Cambrian.

Lingula aurora var. Hall, Sixteenth Rep. New York State Cab. Nat. Hist., 1863, p. 127, pl. 6, figs. 6–8;—Trans. Albany Institute, V, 1867, p. 104;—Twenty-third Rep. New York State Cab. Nat. Hist., 1873, pl. 13, fig. 5.

Lingulella stoneana Whitfield, Geol. Wisconsin, IV, 1882, p. 334, pl. 27, figs. 6, 7.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 2, figs. 9–11.

Loc. Prairie du Sac and Mazomanie, Wisconsin.

Lingulella winona (Hall). Middle Cambrian.

Lingula winona Hall, Sixteenth Rep. New York State Cab. Nat. Hist., 1863, p. 126, pl. 6, fig. 9;—Trans. Albany Institute, V, 1867, p. 102.—Sardeson, Bull. Minnesota Acad. Nat. Sci., IV, 1896, p. 96.

Loc. Lansing, Iowa; Wisconsin.

LINGULEPIS Hall. Genotype Lingula pinniformis Owen.

Lingulepis Hall, Sixteenth Rep. New York State Cab. Nat. Hist., 1863, p. 129.—Meek and Hayden, Pal. Upper Missouri, Smithsonian Cont. to Knowl., XIV, 172, 1864, p.1.—Hall, Trans. Albany Institute, V, 1867, p. 106.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 59, 163;—Eleventh Ann. Rep. New York State Geologist, 1894, p. 231.

Obs. The essential difference between Lingulepis and Lingulella is that the ventral beak of the former is often much attenuated. The amount of attenuation, however, is often a very changeable feature in specimens of a species from a locality. It is this variation and the want of large collections that has lead to the making of too many species of Lingulepis.

Lingulepis acuminata (Conrad). Upper Cambrian.

Lingula acuminata Conrad, Third. Ann. Rep. New York Geol. Survey, 1839, p. 64.—Hall, Pal. New York, I, 1847, p. 9, with fig.—Billings, Geol. Canada, 1863, p. 102, fig. 8.—Matthew, Trans. Royal Soc. Canada, 2d ser., I, 1896, p. 257, pl. 2, fig. 5.

Lingula antiqua Emmons, Geol. New York; Rep. Second Dist., 1842, p. 268, fig. 68.—Hall, Pal. New York, I, 1847, p. 3, pl. 1, fig. 3.—Emmons, American Geology, Pt. II, 1855, p. 202, pl. 4, fig. 7.

Glossina acuminata Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 1, figs. 1, 2.

Loc. Saratoga and Franklin counties, etc., New York; Lansdowne, Bastard, and Beverly, Canada.

Obs. The material of this species in the collection of the U. S. Geological Survey has specimens which are difficult to separate from L. pinniformis and L. dakotensis, and there is every gradation between these and L. acuminata. See L. pinniformis.

Lingulepis acutangulus (Roemer). Upper Cambrian.

Lingula acutangula Roemer, Texas, 1849, p. 420;—Kreidebildung Texas, 1852, p. 90, pl. 11, fig. 10.

Loc. Burnett and Llano counties, Texas.

Lingulepis affinis = Lingulobolus affinis.

Lingulepis cuneolus Whitfield. Upper Cambrian.

Lingulepis cuneolus Whitfield, Powell's Geol. Geogr. Survey Rocky Mountain Region, Prel. Rep., 1877, p. 8;—Ibidem, Final Rep., 1880, p. 336, pl. 2, figs. 5, 6.

Lingulepis perattenuatus Whitfield, Ibidem, Prel. Rep., 1877, p. 9;—Final Rep., 1880, p. 337, pl. 2, figs. 7–9.

Loc. Red Canyon Creek, Black Hills, South Dakota.

Lingulepis dakotensis Meek and Hayden = L. pinniformis.

Lingulepis ella Hall and Whitfield = Lingulella ella.

Lingulepis(?) mæra Hall and Whitfield. Up. Camb. and Pogonip (Ord.).

Lingulepis mæra Hall and Whitfield, King's U. S. Geol. Expl. 40th Parl., IV, 1877, p. 206, pl. 1, figs. 5–7.—Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 12.

Lingulepis? mæra Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 61.

Loc. Secret Canyon, Ruby Hill, and Eureka district, Nevada.

Lingulepis matinalis Hall. Upper Cambrian.

Lingulepis pinnaformis Hall, Sixteenth Rep. New York State Cab. Nat. Hist., 1863, p. 130;—Ibidem, 1863, p. 130, pl. 6, figs. 12, 13.

Obs. A distinct species occurring in numbers in a blue shale just above the trap at St. Croix Falls, Wisconsin.

Lingulepis minima Whitfield = L. prima.

Lingulepis minuta Hall and Whitfield = Obolella whitfieldi.

Lingulepis morsensis N. H. Winchell = Lingula morsei.

Lingulepis perattenuata Whitfield = L. cuneolus.

Lingulepis pinniformis (Owen). Upper Cambrian.

Lingula antiqua and prima (non Emmons, Hall, 1847) Foster and Whitney, Geol. Rep. Lake Superior Dist., II, 1851, p. 204, pl. 23, figs. 1, 2.—Hall, Geol. Wisconsin, I, 1862, p. 21, fig. 3.—Hayden, American Jour. Sci., 2d ser., XXXIII, 1863, p. 73.

Lingula pinnaformis Owen, Geol. Survey Wisconsin, Iowa, Minnesota, 1852, p. 583, pl. 1B, figs. 4, 6, 8.—Hall, Geol. Wisconsin, I, 1862, pp. 21, 435, fig. 3.

Lingulepis pinniformis (Owen)—Continued.

Orbicula prima Owen, Geol. Survey Wisconsin, Iowa, Minnesota, 1852, figs. 17, 19.

Lingulepis pinnaformis Hall, Sixteenth Rep. New York State Cab. Nat. Hist., 1863, p. 129, pl. 6, figs. 14-16;—Trans. Albany Institute, V, 1867, p. 107.—Whitfield, Powell's Geol. Geogr. Survey Rocky Mountain Region, 1880, p. 335, pl. 2, figs. 1-4;—Geol. Wisconsin, IV, 1882, p. 169, pl. 1, figs. 2, 3.

Lingulepis pinniformis and dakotensis Meek and Hayden, Pal. Upper Missouri, Smithsonian Cont. to Knowl., XIV, 172, 1864, pp. 2, 3, pl. 1, fig. 1.

Lingulepis dakotensis Whitfield, Powell's Geol. Geogr. Survey Rocky Mountain Region, 1880, p. 337, pl. 2, figs. 10, 11.

Lingulepis pinniformis Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 60, figs. 22, 23; pl. 1, figs. 35, 36.

Loc. Falls of St. Croix, Hudson, etc., Wisconsin; Black Hills, South Dakota.

Obs. This species also occurs at Ausable Chasm and Whitehall, New York, and are there regarded as L. acuminata. It may be advisable to refer Owen's species to L. acuminata (Conrad).

Lingulepis prima Meek and Hayden=Obolella polita.

Lingulepis prima (Hall). Upper Cambrian.

Lingula ovata Emmons, Geol. New York; Rep. Second Dist., 1842, p. 105 (undefined).

Lingula prima (Conrad MS.) Hall, Pal. New York, I, 1847, p. 3, pl. 1, fig. 2.—Emmons, American Geology, Pt. II, 1855, p. 202.

Obolella prima Whitfield, Bull. American Mus. Nat. Hist., I, 1884, p. 142, pl. 14, figs. 3-5.

Lingulepis minima Whitfield, Ibidem, 1884, p. 141, pl. 14, figs. 1, 2.

Lingulella? prima Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 69.

Loc. Keeseville, Essex, etc., New York; ?Black Hills, South Dakota.

Lingulepis primiformis Whitfield. Upper Cambrian.

Lingulepis primæformis Whitfield, Ludlow's Rep. Reconn. Black Hills South Dakota, 1875, p. 103, pl. 1, fig. 4.

Loc. Black Hills, South Dakota.

LINGULOBOLUS Matthew. Genotype Lingulella(?) affinis Billings.

Lingulobolus Matthew, Trans. Royal Soc. Canada, 2d ser., I, 1896, p. 260.

Lingulobolus affinis (Billings). Lower Ordovician.

Lingulella? affinis Billings, Canadian Nat. Geol., n. ser., VI, 1872, p. 468, fig. 4;—Pal. Fossils, II, 1874, p. 67, fig. 35.

Lingulepis affinis Walcott, American Jour. Sci., 3d ser., XXXVII, 1889, p. 381.

Lingulobolus affinis Matthew, Trans. Royal Soc. Canada, 2d ser., I., 1896, p. 261, pl. 1, fig. 4.

Loc. Bell Island, Newfoundland.

Lingulobolus affinis cuneata Matthew. Lower Ordovician.

Lingulobolus affinis var. cuneata Matthew, Trans. Royal Soc. Canada, 2d ser., I, 1896, p. 262, pl. 1, figs. 4e, 4d.

Loc. Great Bell Island, Conception Bay, Newfoundland.

LINGULODISCINA Whitfield. Genotype Lingula exilis Hall.

Lingulodiscina Whitfield, Bull. American Mus. Nat. Hist., III, 1890, p. 122, figs. 1-8.

Œhlertella Hall and Clarke, Pal. New York, VIII, Pt. I, 1890, pp. 133, 168;—Eleventh Ann. Rep. N. Y. State Geologist, 1894, p. 257.

Lingulodiscina(?) connata (Walcott). Lower Carboniferous.

Discina connata Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 214, pl. 7, fig. 3.

Loc. Eureka district, Nevada.

Lingulodiscina exilis (Hall). Marcellus (Dev.).

Lingula exilis Hall, Thirteenth Rep. N. Y. State Cab. Nat. Hist., 1860, p. 77, fig. 2;—Pal. New York, IV, 1867, p. 7, pl. 1, figs. 8, 9.

Lingulodiscina exilis Whitfield, Bull. American Mus. Nat. Hist., III, 1890, p. 122, figs. 1–8.

Loc. Schoharie County, New York.

Lingulodiscina newberryi (Hall). Waverly (L. Carb.).

Discina newberryi Hall, Sixteenth Rep. N. Y. State Cab. Nat. Hist., 1863, p. 30;—Pal. New York, IV, 1867, p. 25, pl. 1, figs. 10, 11.

Discina (Orbiculoidea) newberryi Meek, Pal. Ohio, II, 1875, p. 277, pl. 14, fig. 1.

Discina newberryi Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 213, pl. 18, fig. 3.—Keyes, Geol. Survey Missouri, V, 1895, p. 40.

Orbiculoidea newberryi Herrick, Bull. Denison Univ., IV, 1888, p. 12;—Geol. Ohio, VII, 1895, pl. 22, figs. 11, 13.

Œhlertella newberryi Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 132, pl. 4F, fig. 18.

Loc. Cuyahoga Falls, Akron, and Farmington, Ohio; Eureka district, Nevada.

Obs. This species should be compared with Orbiculoidea(?) capax (White.)

Lingulodiscina pleurites (Meek). Waverly (L. Carb.).

Discina (Orbiculoidea?) pleurites Meek, Pal. Ohio, II, 1875, p. 278, pl. 14, fig. 2.

Orbiculoidea pleurites Herrick, Bull. Denison Univ., IV, 1888, pp. 12, 19, pl. 3, fig. 5;—Geol. Ohio, VII, 1895, pl. 22, fig. 12.

Œhlertella pleurites Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 132, pl. 4E, figs. 21–24; pl. 4F, figs. 19, 20.

Loc. Newark and Gann, Knox County, Ohio.

LINGULOPS Hall. Genotype L. whitfieldi Hall.

Lingulops Hall, Notes on some New or Imperfectly Known Forms among the Brachiopoda, 1871, p. 2;—Ibidem, 1872, p. 2, pl. 13, figs. 1, 2;—Twenty-third Rep. N. Y. State Cab. Nat. Hist., 1873, p. 244, pl. 13, figs. 1, 2.—Davidson and King, Quart. Jour. Geol. Soc. London, XXX, 1874, p. 164.—Hall and Clarke, Pal. New York, VIII, Pt. 1, 1892, pp. 18, 46, 163;—Eleventh Ann. Rep. N. Y. State Geologist, 1894, p. 233.

Lingulops granti Hall and Clarke. Niagara (Sil.).

Lingulops granti Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 19, 173, pl. 4K, figs. 14, 15.

Loc. Hamilton, Ontario.

Lingulops norwoodi (James). Utica (Ord.).

Lingula norwoodi James, Cincinnati Quart. Jour. Sci., II, 1875, p. 10, fig. 2;—Jour. Cincinnati Soc. Nat. Hist., VI, 1883, p. 235, pl. 10, fig. 1.

Lingulops norwoodi Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 19, pl. 2, figs. 24–26.

Loc. Covington, Kentucky.

Lingulops whitfieldi Hall. Maquoketa (Ord.).

Lingulops whitfieldi Hall, Notes on some New or Imperfectly Known Forms among the Brachiopoda, 1872, p. 2, pl. 13, fig. 12;—Twenty-third Rep. N. Y. State Cab. Nat. Hist., 1873, pl. 13, figs. 1, 2.—Davidson and King, Quart. Jour. Geol. Soc. London, XXX, 1874, p. 164, pl. 19, fig. 9.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 19, pl. 2, figs. 27–30.

Loc. Near Lattners, Dubuque County, Iowa.

LINNARSSONIA Walcott. Genotype Obolella transversa Hartt.

Linnarssonia Walcott, American Jour. Sci., 3d ser., XXIX, 1885, p. 115; XXX, p. 21.—Matthew, Trans. Royal Soc. Canada, III, 1886, p. 35.—Hall and

LINNARSSONIA Walcott—Continued.

Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 107, 167;—Eleventh Ann. Rep. N. Y. State Geologist, 1894, p. 251.—Matthew, Trans. Royal Soc. Canada, IX, 1892, p. 42.

Linnarssonia belti Davidson. Upper Cambrian.

Linnarssonia belti ? Matthew, Trans. Royal Soc. Canada, IX, 1892, p. 42, pl. 12, figs. 7a–7c.

Loc. Near St. John, New Brunswick.

Linnarssonia misera (Billings). Middle Cambrian.

Obolella? misera Billings, Canadian Nat. Geol., n. ser., VI, 1872, p. 470.

Linnarssonia misera Matthew, Trans. Royal Soc. Canada, III, 1886, p. 35, fig. 12.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 108, pl. 8, figs. 35–37.

Loc. Trinity Bay, Newfoundland; St. Martins, New Brunswick.

Linnarssonia pretiosa (Billings). Upper Cambrian.

Obolella pretiosa Billings, Pal. Fossils, I, 1862, p. 68, fig. 61;—Geol. Canada, 1863, p. 230, fig. 239.

Obolella? pretiosa Walcott, Bull. U. S. Geol. Survey, 30, 1886, p. 111.

Linnarssonia pretiosa Dawson, Trans. Royal Soc. Canada, VII, 1889, p. 53, fig. 26.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 70, pl. 3, figs. 43, 44.

Loc. Bridge of the Grand Trunk Railroad across the Chaudiere River; Cape Rouge; Little Metis; Sillery and Point Levis, Canada.

Linnarssonia sagittalis taconica Walcott. Lower and Middle Cambrian.

Linnarssonia taconica Walcott, American Jour. Sci., 3d ser., XXXIV, 1887, p. 189, pl. 1, fig. 18.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 106.

Linnarssonia sagittalis Walcott, Proc. U. S. Nat. Mus., XI, 1888, p. 442.

Linnarssonia sagittalis var. taconica Walcott, American Jour. Sci., 3d ser., XXXVIII, 1889, p. 36;—Tenth Ann. Rep. U. S. Geol. Survey, 1891, p. 610, pl. 68, fig. 1.

Loc. Washington County, New York; Mount Stephan, British Columbia.

Linnarssonia taconica Walcott=L. sagittalis taconica.

Linnarsonia transversa (Hartt). Middle Cambrian.

Obolella transversa Hartt, Dawson, Acadian Geol., 2d ed., 1868, p. 644.—Walcott, Bull. U. S. Geol. Survey, 10, 1884, p. 16, pl. 1, fig. 5.

Linnarssonia transversa Walcott, American Jour. Sci., 3d ser., XXIX, 1885, p. 116, figs. 3, 4, 6.—Matthew, Trans. Royal Soc. Canada, III, 1886, p. 35, pl. 5, fig. 11.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 108, pl. 3, figs. 38–42.—Matthew, Trans. N. Y. Acad. Sci., XIV, 1895, p. 125, pl. 5, figs. 1, 2.

Loc. St. John, New Brunswick.

LISSOPLEURA Whitfield. Genotype Rhynchonella æquivalvis Hall.

Lissopleura Whitfield, Bull. Am. Mus. Nat. Hist., VIII, 1896, p. 232.

Lissopleura æquivalvis (Hall). Lower Helderberg (Dev.).

Rhynchonella æquivalvis Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 66;—Pal. New York, III, 1859, p. 224, pl. 29, pp. 2, 3.

Lissopleura æquivalvis Whitfield, Bull. Am. Mus. Nat. Hist., VIII, 1896, p. 232, figs. 1–5.

Loc. Helderberg Mountains, New York.

MARTINIA McCoy. Genotype Anomites glabra Martin.

Martinia McCoy, Carboniferous Fossils Ireland, 1844, p. 128, fig. 18; p. 139, fig. 132.—King, Mon. Permian Fossils, Pal. Soc., 1850, pp. 81, 134.—Meek and Hayden, Pal. Upper Missouri, Smithsonian Cont. to Knowl., XIV, 172, 1864, p. 19.—Waagen, Palæontologica Indica, Ser. XIII, I, 1883, p. 528.—Herrick, Bull. Denison Univ., IV, 1888, p. 14.—Hall and Clarke, Pal. New York, VIII, *Pt. II, 1893*, pp. 9, 32, 40.

Martinia athyroides A. Winchell. Hamilton (Dev.).

Martinia athyroides A. Winchell, Rep. Lower Peninsula Michigan, 1866, p. 94.

Loc. Grand Traverse region, Michigan.

Martinia glabra (Martin). Upper Carboniferous.

Anomites glabra Martin, Petrefacta Derbiensia, 1809, pl. 48, figs. 9, 10.

Spirifera glabra Davidson, Quart. Jour. Geol. Soc. London, XIX, 1863, p. 170, pl. 9, figs. 9, 10.—Dawson, Acadian Geology, 3d ed., 1878, p. 291, fig. 89.

Loc. Europe; Pictou, Windsor, etc., Nova Scotia.

Martinia glabra contracta (Meek and Worthen). Kaskaskia (L. Carb.).

Spirifera glabra var. contracta Meek and Worthen, Proc. Acad. Nat. Sci. Philadelphia, 1861, p. 143;—Geol. Survey Illinois, II, 1866, p. 298, pl. 23, fig. 5.—White, Wheeler's Expl. Survey west 100th Merid., IV, 1875, p. 136, pl. 10, fig. 2.

Spirifera (Martinia) contractus Whitfield, Annals N. Y. Acad. Sci., V, 1891, p. 583, pl. 13, figs. 17–19.

Spirifera (Martinia) contracta Whitfield, Geol. Ohio, VII, 1895, p. 471, pl. 9, figs. 17–19.

Loc. Chester, Illinois; Newtonville, Ohio; Lincoln County, Nevada.

Martinia glanscerasi (White). Hamilton (Dev.).

Spirifera glanscerasi White, Proc. Boston Soc. Nat. Hist., IX, 1862, p. 24.

Loc. Iowa City, Iowa.

Martinia(?) insolita A. Winchell. Huron (Dev.).

Spirifera? insolita A. Winchell, Proc. Acad. Nat. Sci. Philadelphia, 1862, p. 406.

Loc. Port aux Barques, Michigan.

Martinia lævigata (Swallow). Keokuk (L. Carb.).

Spirifera lævigata Swallow, Trans. St. Louis Acad. Sci., II, 1863, p. 86.

Loc. Iowa and Missouri.

Obs. Regarded by Keyes as a synonym for Spirifer logani.

Martinia maia (Billings). Corniferous (Dev.).

Athyris maia Billings, Canadian Jour. Sci., V, 1860, p. 276, figs. 33, 34;—Geol. Canada, 1863, p. 373, fig. 398.

Athyris? maia Nicholson, Pal. Prov. Ontario, 1874, p. 88.

Spirifera maia Hall, Pal. New York, IV, 1867, p. 116, pl. 63, figs. 6–13.—Davidson, Suppl. British Sil. Brach., Paleontographical Soc., 1882, p. 122.—Whitfield, Annals N. Y. Acad. Sci., V, 1891, p. 549, pl. 11, fig. 14.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 38, figs. 5, 6.—Whitfield, Geol. Ohio, VII, 1895, p. 444, pl. 7, fig. 14.

Spirifera (Martinia) maia Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 141, pl. 14, fig. 13 (?pl. 3, fig. 1).

Loc. St. Marys, Township of Blanchard, Ontario; Columbus and Delaware, Ohio; Eureka district, Nevada.

Martinia meristoides Meek. Middle Devonian.

Spirifera (Martinia) meristoides Meek, Trans. Chicago Acad. Sci , I, 1868, p. 106, pl. 14, fig. 3.—Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 142.—Whiteaves, Cont. Canadian Pal., I, 1891, p. 226.

Loc. Mackenzie River Basin, British America.

Martinia planoconvexa Meek and Hayden=Amboccelia planiconvexa.

Martinia sublineata Meek. Middle Devonian.

Spirifera (Martinia) sublineata Meek, Trans. Chicago Acad. Sci., I, 1868, p. 103, pl. 14, fig. 1.

Loc. Great Slave Lake, British America.

Martinia subumbona (Hall). Hamilton-Portage (Dev.).

Orthis subumbona Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 168.

Amboccelia subumbona Hall, Thirteenth Rep. Ibidem, 1860, p. 71.

Spirifera subumbona Hall, Pal. New York, IV, 1867, p. 234, pl. 33, figs. 22–30.

Martinia subumbona Miller, N. American Geol. Pal., 1889, p. 352.

Spirifer subumbona Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 29, fig. 14.

Loc. Shore of Lake Erie, Tully, and McKinneys Station, New York.

Obs. Professor Williams says this species is a synonym for Amboccelia gregaria.

MEEKELLA White and St. J. Genotype Plicatula striatocostata Cox.

Meekella White and St. John, Trans. Chicago Acad. Sci., I, 1868, p. 120, figs. 4–6.—Meek, Final Rep. U. S. Geol. Survey Nebraska, 1872, p. 175.—Waagen, Palæontologica Indica, Ser. XIII, I, 1884, p. 576.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 264;—Eleventh Ann. Rep. N. Y. State Geologist, 1894, p. 287.

Meekella occidentalis (Newberry). Upper Carboniferous.

Streptorhynchus occidentalis Newberry, Ives's Rep. Colorado River of the West, 1861, p. 126, pl. 1, fig. 5.

Meekella occidentalis Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 266, pl. 11B, figs. 18, 19.

Loc. Canyon of Cascade River.

Obs. See Meekella pyramidalis.

Meekella (?) occidentalis (Swallow). Upper Carboniferous.

Orthisina occidentalis Swallow, Trans. St. Louis Acad. Sci., II, 1863, p. 82.

Loc. Caldwell County, Missouri.

Obs. If a Meekella it should be compared with M. striaticostata. Regarded by Keyes as a synonym for M. striaticostata.

Meekella pyramidalis (Newberry). Upper Carboniferous.

Streptorhynchus pyramidalis Newberry, Ives's Rep. Colorado River of the West, 1861, p. 126, pl. 2, figs. 11–13.

Meekella pyramidalis Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 266.

Loc. Colorado River.

Obs. This species is quite distinct from M. striaticostata Cox, with which it has been confounded. M. occidentalis Newberry, however, may prove to be but a large individual of M. pyramidalis.

Meekella striaticostata (Cox). Upper Carboniferous.

Plicatula striatocostata Cox, Owen's Geol. Survey Kentucky, III, 1857, p. 568, pl. 8, fig. 7.

Orthisina shumardianus Swallow, Trans. St. Louis Acad. Sci., I, 1858, p. 183.

Orthisina missouriensis Swallow, Ibidem, 1858, p. 219.—Meek and Hayden, Proc. Acad. Nat. Sci. Philadelphia, III, 1859, p. 26.

Orthisina shumardiana Meek and Hayden, Ibidem, 1859, p. 26.

Orthis striatocosta Geinitz, Carbon und Dyas in Nebraska, 1866, p. 48, pl. 3, figs. 22–24.

Meekella striatocostata White and St. John, Trans. Chicago Acad. Sci., I, 1868, pp. 120, 122, figs. 4–6.—Meek, Final Rep. U. S. Geol. Survey Nebraska, 1872, p. 175, pl. 5, fig. 12.—Meek and Worthen, Geol. Survey Illinois, V, 1873, p. 571, pl. 26, fig. 21.—White, Wheeler's Expl. Survey west 100th Merid., IV, 1875, p. 26, pl. 9, fig. 4.—Kayser, Richthofen's China, IV, 1883, p. 178, pl. 23, fig. 8.—White, Thirteenth Rep. State Geol. Indiana, 1884, p. 130, pl. 26, figs. 12–14.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 265, pl. 10, figs. 18–23; pl. 11B, figs. 20–22.—Keyes, Geol. Survey Missouri, V, 1895, p. 68, pl. 39, fig. 1.

Meekella striaticostata (Cox)—Continued.

Streptorhynchus (Meekella) striatocostata Hall, Second Ann. Rep. New York State Geol., 1883, pl. 40, figs. 18-23.

Loc. Hopkins County, Kentucky; Indiana; Illinois; Missouri; Iowa; Nebraska; New Mexico; Nevada; Utah; ?China.

Obs. See M. occidentalis (Swallow).

MEGALANTERIS Œhlert. Genotype Terebratula archiaci de Verneuil.

Meganteris Suess, Sitz. der k. k. Akad. der Wissensch. zu Wien, XVIII, 1855, p. 51.

Megalanteris Œhlert, Fischer's Manuel de Conchyliologie, 1887, p. 1319.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 277;—Thirteenth Ann. Rep. N. Y. State Geologist, 1895, p. 859.

Megalanteris condoni (McChesney). Oriskany (Dev.).

Rensselæria condoni McChesney, New Pal. Fossils, 1861, p. 85;—Trans. Chicago Acad. Sci., I, 1868, p. 36, pl. 7, fig. 2.—Meek and Worthen, Geol. Survey Illinois, III, 1868, p. 401, pl. 8, fig. 4.

Newberria? condoni Hall, Tenth Ann. Rep. N. Y. State Geol., 1891, p. 7 of extract.

Megalanteris condoni Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 280.

Loc. West of Jonesboro, Union County, Illinois.

Megalanteris ovalis Hall. Oriskany (Dev.).

Meganteris ovalis Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 101.

Rensselæria ovalis Hall, Pal. N. Y., III, 1859, p. 458, pl. 106, fig. 2.—Billings, Geol. Canada, 1863, p. 962, fig. 471.

Megalanteris ovalis Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 280, pl. 77, figs. 12-22.

Loc. Albany and Schoharie counties, New York.

Meganteris æquiradiata Hall=Rensselæria æquiradiata.

Meganteris cumberlandiæ Hall=Rensselæria cumberlandiæ.

Meganteris elliptica Hall=Rensselæria elliptica.

Meganteris elongata Hall=Amphigenia elongata.

Meganteris lævis Hall=Meristella lævis.

Meganteris mutabilis Hall=Rensselæria mutabilis.

Meganteris ovalis Hall=Megalanteris ovalis.

Meganteris ovoides Hall=Rensselæria ovoides.

Meganteris subtrigonalis Hall=Amphigenia elongata subtrigonalis.

Meganteris suessana Hall=Beachia suessana.

Megerlia dubitanda Cooper=Terebratella(?) dubitanda.

MERISTA Suess. Genotype Atrypa herculea Barrande.

Merista Suess, Jahrbuch Köngl. Kais. Geol. Reichs., II, 1851, pp. 150, 160.—Hall, Thirteenth Rep. N. Y. State Cab. Nat. Hist., 1860, p. 73;—Twentieth Rep. N. Y. State Cab. Nat. Hist., 1867, p. 258.—Dall, Bull. U. S. Nat. Mus., 8, 1877, p. 47.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 70, fig. 54;—Thirteenth Ann. Rep. N. Y. State Geologist, 1895, p. 771.

Camarium Hall, Twelfth Rep. N. Y. State Cab. Nat. Hist., 1859, p. 42;—Pal. New York, III, 1859, p. 486;—Fifteenth Rep. N. Y. State Cab. Nat. Hist., 1862, p. 176.

Merista arcuata Hall=Meristella arcuata.

Merista bella Hall=Meristella bella.

Merista bisulcata Hall=Whitfieldella bisulcata.

Merista crassirostra Hall=Whitfieldella cylindrica.

Merista cylindrica Hall=Whitfieldella cylindrica.

Merista elongata (Hall). Lower Helderberg (Dev.).

Camarium elongatum Hall, Pal. New York, III, 1859, p. 488, pl. 95A, fig. 4.

Loc. Cumberland, Maryland.

Obs. Probably only a variety of M. typa.

Merista houghtoni Winchell=Meristella houghtoni.

Merista lævis Hall=Meristella lævis.

Merista lata Hall=Meristella lata.

Merista lens Hall=Meristella lens.

Merista meeki Hall=Meristella meeki.

Merista princeps Hall=Meristella princeps.

Merista subquadrata Hall=Meristella subquadrata.

Merista tennesseensis Hall and Clarke. Lower Helderberg (Dev.).

Merista tennesseensis Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pp. 71, 365, pl. 42, figs. 1–6.

Loc. Perry County, Tennessee.

Merista typus Hall. Lower Helderberg (Dev.).

Camarium typum Hall, Pal. New York, III, 1859, p. 487, pl. 95A, figs. 2a, 3, 5, 6.

Merista typum Hall, Thirteenth Rep. N. Y. State Cab. Nat. Hist., 1860, p. 93, figs. 10–13.

Merista typa Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 42, figs. 7–12.

Loc. Cumberland, Maryland.

MERISTELLA Hall, 1860. Genotype Merista arcuata Hall.

†Meristella Hall, Twelfth Rep. N. Y. State Cab. Nat. Hist., 1859, p. 78.

Meristella Hall, Thirteenth Rep. Ibidem, 1860, pp. 74, 93;—Sixteenth Rep. Ibidem, 1863, p. 50, figs. 27–34;—Trans. Albany Institute, IV, 1863, p. 139;—American Jour. Sci., 2d ser., XXXV, 1863, p. 396; XXXVI, p. 11;—Twentieth Rep. N. Y. State Cab. Nat. Hist., 1867, pp. 155, 258;—Pal. New York, IV, 1867, p. 295.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 97.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 73, figs. 55, 56;—Thirteenth Ann. Rep. N. Y. State Geologist, 1895, p. 773.

Athyris Billings, Proc. Portland Soc. Nat. Hist., 1863, p. 115.

Meristella arcuata Hall. Lower Helderberg (Dev.).

Merista arcuata Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 95, figs. 1–4;—Pal. New York, III, 1859, p. 249, pl. 41, fig. 1 (?2).

Meristella arcuata Hall, Ibidem, IV, 1867, p. 298, figs. 1, 2.—Hall and Clarke, Ibidem, VIII, Pt. II, 1895, pl. 43, figs. 1, 2; pl 44, fig. 5.

Loc. Albany and Schoharie counties, New York; St. Blandine, New Brunswick.

Meristella barrisi Hall. Marcellus-Hamilton (Dev.).

Meristella barrisi Hall, Thirteenth Rep. N. Y. State Cab. Nat. Hist., 1860, p. 84;—Pal. New York, IV, 1867, p. 304, pl. 49, figs. 5–22.—†Tschernyschew, Mémoires du Comité Géologique de St. Pétersbourg, III, 3, 1887, p. 55, pl. 9, figs. 12, 15; pl. 13, figs. 1, 2.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 43, figs. 25, 26; pl. 44, figs. 27–30.

Loc. York and Leroy, New York; Urals of Russia.

Meristella bella (Hall). Lower Helderberg (Dev.).

Merista bella Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 92, figs. 1–7;—Pal. New York, III, 1859, p. 248, pl. 40, fig. 1.

Meristella bella Whitfield, Annals N. Y. Acad. Sci., V, 1891, p. 510, pl. 5, figs. 8–10.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 43, figs. 7–9; pl. 44, figs. 1–3.—Whitfield, Geol. Ohio, VII, 1895, p. 412, pl. 1, figs. 8–10.

Loc. Albany and Schoharie counties, New York; Greenfield, Ohio; Lake Temiscouata, New Brunswick.

Meristella(?) blancha (Billings). Lower Helderberg (Dev.).

Athyris blancha Billings, Proc. Portland Soc. Nat. Hist., 1863, p. 115, pl. 3, fig. 13.

Meristina (?) blancha Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 68, pl. 41, figs. 22, 23.

Loc. Square Lake, Maine.

Obs. Compare with Meristella arcuata.

Meristella clusia (Billings). Corniferous (Dev.).

Athyris? clusia Billings, Canadian Jour. Sci., V, 1860, p. 279.

Loc. Cayuga, Ontario.

Meristella doris Hall. Upper Helderberg (Dev.).

Meristella doris Hall, Thirteenth Rep. N. Y. State Cab. Nat. Hist., 1860, p. 84;—Pal. New York, IV, 1867, p. 303, pl. 50, figs. 1–12.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 43, figs. 21, 22.

Charionella doris Billings, Geol. Canada, 1863, p. 374, figs. 400E, 401a, b.

Loc. Schoharie and Williamsville, New York; Cayuga, Ontario.

Meristella elissa Hall=Meristella nasuta.

Meristella haskinsi Hall. Hamilton (Dev.).

Meristella haskinsi Hall, Thirteenth Rep. N. Y. State Cab. Nat. Hist., 1860, p. 84;—Pal. New York, IV, 1867, p. 306, pl. 49, figs. 23–35.—Hall and Clarke, Ibidem, VIII, Pt. II, 1895, pl. 43, figs. 23, 24; pl. 44, fig. 31.

Loc. Seneca Lake, York, Moscow, etc., New York; Thedford, Ontario.

Meristella (?) houghtoni (A. Winchell). Huron (Dev.).

Merista houghtoni Winchell, Proc. Acad. Nat. Sci. Philadelphia, 1862, p. 407.

Meristella (?) houghtoni Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 78.

Loc. Port aux Barques, Michigan.

Meristella (?) incerta Simpson. Waverly (L. Carb.).

Meristella incerta Simpson, Trans. American Philosophical Soc., n. ser., XVI, 1889, p. 442, fig. 7.

Loc. Warren, Pennsylvania.

Obs. Based upon a crushed and broken specimen.

Meristella lævis (Vanuxem). Lower Helderberg (Dev.).

Atrypa lævis Vanuxem, Geol. New York; Rep. Third Dist., 1842, p. 120, fig. 2.—Rogers, Geol. Pennsylvania, II, Pt. II, 1858, p. 825, fig. 642.

Merista lævis Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 94, figs. 1–6;—Pal. New York, III, 1859, p. 247, pl. 39, figs. 3, 4.—Meek and Worthen, Geol. Survey Illinois, III, 1868, p. 376, pl. 7, fig. 8.

Meristella lævis Whitfield, Annals N. Y. Acad. Sci., V, 1891, p. 510, pl. 5, figs. 6, 7.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 43, figs. 3–6; pl. 44, fig. 4.—Whitfield, Geol. Ohio, VII, 1895, p. 411, pl. 1, figs. 6, 7.

Loc. Albany and Schoharie counties, New York; Greenfield, Ohio; Perry County, Missouri; Pennsylvania; Square Lake, Maine; St. Blandine, New Brunswick.

Meristella (?) lævis (Hall). Lower Helderberg (Dev.).

Meganteris lævis Hall (non Vanuxem), Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 99.

Rensselæria lævis Hall, Pal. New York, III, 1859, p. 256, pl. 40, fig. 2.

Loc. Albany County, New York.

Meristella lata Hall. Oriskany (Dev.).

Merista lata Hall, Pal. New York, III, 1859, p. 431, pl. 101, fig. 3.

Meristella lata Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 78, pl. 44, fig. 12.

Loc. Albany and Schoharie counties, New York; Cayuga, Ontario.

Meristella lens (A. Winchell). Hamilton (Dev.).

Merista lens A. Winchell, Rep. Lower Peninsula Michigan, 1866, p. 94.

Meristella lens Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 78.

Loc. Grand Traverse region, Michigan.

Meristella lenta Hall. Oriskany (Dev.).

Meristella lenta Hall, Pal. New York, IV, 1867, p. 420, pl. 63, figs. 19–22.—Hall and Clarke, Ibidem, VIII, Pt. II, 1895, pl. 44, figs. 15–18.

Loc. Cayuga, Ontario.

Meristella maria Hall=Meristina maria.

Meristella meeki Hall. Lower Helderberg (Dev.).

Merista meeki Hall, Tenth Rep. N. Y. State Cab. Nat. Hist, 1857, p. 97;—Pal. New York, III, 1859, p. 252, pl. 44, fig. 6.

Camarium meeki Hall, Ibidem, III, 1859, p. 486.

Meristella meeki Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 78.

Loc. Perry County, Tennessee.

Meristella meta Hall. Hamilton (Dev.).

Meristella meta Hall, Pal. New York, IV, 1867, p. 308, pl. 49, figs. 1–4.—Hall and Clarke, Ibidem, VIII, Pt. II, 1895, pl. 43, figs. 29, 30.

Loc. Delphi, New York.

Meristella nasuta (Conrad). Upper Helderberg (Dev.).

Atrypa nasuta Conrad, Jour. Acad. Nat. Sci. Philadelphia, VIII, 1842, p. 265.

Terebratula valenciennii Castelnau, Essai Syst. Sil. l'Amérique Septentrionale, 1843, p. 39, pl. 13, fig. 6.

Meristella nasuta Hall, Thirteenth Rep. N. Y. State Cab. Nat. Hist., 1860, p. 93, figs. 8, 9;—Fifteenth Rep. Ibidem, 1862, p. 160, figs. 17–22 on p. 161;—Pal. New York, IV, 1867, p. 299, pl. 48, figs. 1–25.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 98, pl. 15, figs. 2–8.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 43, figs. 18–20; pl. 44, figs. 13, 14, 19–26.

Athyris clara Billings, Canadian Jour. Sci., V, 1860, p. 274, figs. 29–32;—Geol. Canada, 1863, p. 373, fig. 397;—Canadian Nat. Geol., n. ser., VII, 1874, p. 240.

Meristella elissa Hall, Fourteenth Rep. N. Y. State Cab. Nat. Hist., 1861, p. 100;—Fifteenth Rep. Ibidem, 1862, pl. 3, figs. 21, 22.

Athyris nasuta Nicholson, Pal. Prov. Ontario, 1874, p 86.

Meristella (Whitfieldia) nasuta Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 148, pl. 3, fig. 8.

Loc. Schoharie, Clarence, Williamsville, etc., New York; Cayuga, Ontario; Columbus and Dublin, Ohio; Falls of Ohio; Lone Mountain, Nevada.

Meristella nucleolata Whitfield=Whitfieldella nucleolata.

Meristella princeps Hall. Lower Helderberg (Dev.).

Merista princeps Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 95, figs. 1–5;—Pal. New York, III, 1859, p. 251, pl. 44, figs 1–5.

Camarium princeps Hall, Ibidem, III, 1859, p. 486.

Meristella princeps Hall, Thirteenth Rep. N. Y. State Cab. Nat. Hist., 1860, p. 93, figs. 5–7.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 43, figs. 10–13.

Loc. Carlisle and Schoharie, New York; St. Blandine, New Brunswick.

Meristella rectirostra Hall=Meristina rectirostris.

Meristella riskowskyi A. Ulrich. Middle Devonian.

Meristella riskowskyi A. Ulrich, N. Jahrb. f. Mineral., Beilageband, VIII, 1892, p. 64, pl. 4, figs. 16–18.

Loc. Chahuarani and near Oconi, Bolivia.

Meristella rostrata Hall. Hamilton (Dev.).

Atrypa rostrata Hall, Geol. New York; Rep. Fourth Dist., 1843, p. 202, fig. 2.
Athyris? rostrata Billings, Canadian Jour. Sci., V, 1860, p. 281, figs. 43, 44.
Charionella rostrata Billings, Geol. Canada, 1863, p. 385, fig. 420.
Meristella rostrata Hall, Pal. New York, IV, 1867, p. 307, pl. 50, figs. 13–17.—Hall and Clarke, Ibidem, Vol. VIII, Pt. II, 1895, pl. 43, figs. 27, 28.
Loc. Eighteen Mile Creek, etc., New York; Bosanquet, Ontario.

Meristella subquadrata Hall. Lower Helderberg (Dev.)

Merista subquadrata Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 93;—Pal. New York, III, 1859, p. 249, pl. 40, fig. 3.
Meristella subquadrata Hall and Clarke, Ibidem, VIII, Pt. II, 1893, p. 78, pl. 43, figs. 14, 15.
Loc. Schoharie and Carlisle, New York.

Meristella unisulcata Hall = Pentagonia unisulcata.

Meristella unisulcata biplicata Hall = Pentagonia unisulcata biplicata.

Meristella unisulcata uniplicata Hall = Pentagonia unisulcata uniplicata.

Meristella walcotti Hall and Clarke. Oriskany (Dev.).

Meristella walcotti Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pp. 77, 365, figs. 55, 56, pl. 43, figs. 16, 17; pl. 44, figs. 6–11, 23, 32.
Loc. Cayuga, Ontario.

MERISTINA Hall. Genotype Meristella maria Hall.

Meristina Hall, Twentieth Rep. N. Y. State Cab. Nat. Hist., 1867, p. 157;—Pal. New York, IV, 1867, p. 299.—Nettelroth (partim), Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 101.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 65;—Thirteenth Ann. Rep. N. Y. State Geologist, 1895, p. 770.
Whitfieldia Davidson, Supplement British Sil. Brach., Paleontographical Soc., 1882, p. 107.—Beecher and Clarke, Mem. New York State Mus., I, 1889, p. 73.

Meristina maria Hall. Niagara (Sil.).

Athyris tumida Roemer, Sil. Fauna west. Tennessee, 1860, p. 70, pl. 5, fig. 12.
Meristella maria Hall, Trans. Albany Institute, IV, 1863, p. 212.—Hall and Whitfield, Twenty-fourth Rep. N. Y. State Cab. Nat. Hist., 1872, p. 196.
Meristina maria Hall, Twentieth Rep. N. Y. State Cab. Nat. Hist., 1867, p. 157;—Pal. New York, IV, 1867, p. 299.—Hall and Whitfield, Pal. Ohio, II, 1875, p. 132, pl. 7, figs. 5, 6.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 101, pl. 29, figs. 7–10.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 67, pl. 41, figs. 1–17.
Meristella tumida Etheridge, Quart. Jour. Geol. Soc. London, XXXIV, 1878, p. 597.
Meristella (Meristina) maria Hall, Twenty-eighth Rep. N. Y. State Mus. Nat. Hist., 1879, p. 159, pl. 25, figs. 8–12;—Eleventh Rep. State Geol. Indiana, 1882, p. 299, pl. 25, figs. 8–12.
Whitfieldia maria Beecher and Clarke, Mem. N. Y. State Mus., I, 1889, p. 73, pl. 7, figs. 1–3.
Loc. Waldron, Indiana; Springfield, Ohio; Louisville, Kentucky; Perry County, Tennessee; Bridgeport, Illinois; Racine, Wisconsin; Bessels Bay, 81° 6′.
Obs. This species is not identical with M. tumida Dalman.

Meristina nitida Hall = Whitfieldella nitida.

Meristina rectirostris Hall. Niagara (Sil.).

Meristella rectirostra Hall, Descriptions n. sp. Fossils from Waldron, Indiana, 1879, p. 15;—Eleventh Rep. State Geol. Indiana, 1882, p. 301, pl. 27, figs. 10–14;—Trans. Albany Institute, X, 1883, p. 71.—Beecher and Clarke, Mem. N. Y. State Mus., I, 1889, p. 67, pl. 7, figs. 4, 5, 11–13.

Meristina rectirostris Hall—Continued.

Meristina rectirostra Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 68, figs. 52, 53, pl. 41, figs. 18–21.

Loc. Waldron, Indiana.

Meristina trisinuata (McChesney). Niagara (Sil.).

Pentamerus trisinuatus McChesney, Descriptions New Pal. Fossils, 1861, p. 86.

Athyris? trisinuatus McChesney, Trans. Chicago Acad. Sci., I, 1868, p. 33, pl. 8, fig. 2.

Loc. Milwaukee, Wisconsin.

Obs. Probably synonymous with Meristina maria.

METAPLASIA Hall and Clarke. Genotype Spirifer pyxidata Hall.

Metaplasia Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 56;—Thirteenth Ann. Rep. N. Y. State Geologist, 1895, p. 762.

Metaplasia disparilis (Hall). Corniferous (Dev.).

Spirifer disparilis Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 134.

Spirifera disparilis Hall, Pal. New York, IV, 1867, p. 204, pl. 30, figs. 10–15.

Metaplasia pyxidata Hall and Clarke, Ibidem, VIII, Pt. II, 1895, pl. 39, figs. 19–22.

Loc. Williamsville and Clarence Hollow, New York.

Metaplasia pyxidata Hall. Oriskany (Dev.).

Spirifer pyxidata Hall, Pal. New York, III, 1859, p. 428, pl. 100, figs. 9–12.

Metaplasia pyxidata Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 56.

Loc. Albany and Schoharie counties, New York; Cumberland, Maryland; Cayuga, Ontario.

Micromitra Meek=Iphidea.

MIMULUS Barrande. Genotype M. perversus Barrande.

Mimulus Barrande, Système Silurien du Centre de la Bohème, V, 1879, p. 109.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 272;—Eleventh Ann. Rep. N. Y. State Geologist, 1894, p. 289.

Mimulus waldronensis (Miller and Dyer). Niagara (Sil.).

Spirifera (?) waldronensis Miller and Dyer, Jour. Cincinnati Soc. Nat. Hist., I, 1878, p. 37, pl. 2, fig. 3.

Triplesia putillus Hall, Descriptions n. sp. Fossils Waldron, Indiana, 1879, p. 16;—Eleventh Rep. State Geol. Indiana, 1882, p. 298, pl. 27, figs. 19–22;—Trans. Albany Institute, X, 1883, p. 72.

Streptis waldronensis Beecher and Clarke, Mem. New York State Mus., I, 1889, p. 30, pl. 3, figs. 9, 10.

Mimulus waldronensis Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 273, pl. 11C, figs. 23–28.

Loc. Waldron, Indiana.

MONOMORELLA Billings. Genotype M. prisca Billings.

Monomorella Billings, Canadian Nat. Geol., n. ser., VI, 1871, p. 220;—American Jour. Sci., 3d ser., III, 1872, p. 358.—Davidson and King, Quart. Jour. Geol. Soc. London, XXX, 1874, p. 155.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 40, 46;—Eleventh Ann. Rep. N. Y. State Geologist, 1894, p. 238.

Monomorella egani Hall and Clarke. Niagara (Sil.).

Monomorella egani Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 42, 175, pl. 4C, fig. 16.

Loc. Near Grafton, Wisconsin.

Monomorella greenei Hall and Clarke. Niagara (Sil.).

Monomorella greenii Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 42, 174, pl. 4D, figs. 5–10.

Loc. Near Grafton, Wisconsin; Risingsun, Ohio.

Monomorella kingi Hall and Clarke. Niagara (Sil.).

Monomorella kingi Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 42, 174, pl. 4D, figs. 1, 2.

Loc. Near Cedarburg, Wisconsin; Hawthorne, Illinois.

Monomorella newberryi Hall and Whitfield. Niagara (Sil.).

Monomorella newberryi Hall and Whitfield, Pal. Ohio, II, 1875, p. 131, pl. 7, figs. 1, 2.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 4C, figs. 1, 2.

Loc. Genoa, Ohio.

Monomorella orbicularis Billings. Guelph (Sil.).

Monomorella orbicularis Billings, Canadian Nat. Geol., n. ser., VI, 1871, p. 221;—American Jour. Sci., 3d ser., III, 1872, p. 359.—Davidson and King, Quart. Jour. Geol. Soc. London, XXX, 1874, p. 158, pl. 17, fig. 10.

Monomorella cnf. orbicularis Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 4C, figs. 3–5.

Loc. Hespelar, Ontario; near Grafton, Wisconsin.

Monomorella ortoni Hall and Clarke. Niagara (Sil.).

Monomorella ortoni Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 42, 175, pl. 4C, figs. 14, 15.

Loc. Risingsun, Wood County, Ohio.

Monomorella ovata Whiteaves. Guelph (Sil.).

Monomorella ovata Whiteaves, Pal. Fossils, III, 1884, p. 5, pl. 2, fig. 1; pl. 8, fig. 1.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 42, pl. 4D, figs. 13–15.

Loc. Durham, Ontario.

Monomorella ovata lata Whiteaves. Guelph (Sil.).

Monomorella ovata var. lata Whiteaves, Pal. Fossils, III, 1884, p. 6, pl. 2, fig. 2; pl. 8, fig. 2.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 4, figs. 11, 12; pl. 4C, figs. 17, 18.

Loc. Durham, Ontario; Hawthorne, Illinois.

Monomorella prisca Billings. Guelph (Sil.).

Monomorella prisca Billings, Canadian Nat. Geol, n. ser., VI, 1871, p. 221;—American Jour. Sci., 3d ser., III, 1872, p. 359.—Davidson and King, Quart. Jour. Geol. Soc. London, XXX, 1874, p. 156, pl. 17, figs. 5–8.—Nicholson, Pal. Prov. Ontario, 1875, p. 68, fig. 38.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 4C, figs. 6–13.

Loc. Hespelar and Elora, Ontario; Risingsun, Wood County, Ohio; Hawthorne, Port Byron, and Cicero, Illinois.

NEWBERRYA Hall. Genotype Rensselæria? johanni Hall.

Rensselandia Hall, Pal. New York, IV, 1867, p. 385.

Newberria Hall, Cont. Canadian Pal., I, 1891, p. 236;—Tenth Ann. Rep. N. Y. State Geol., 1891, p. 91 (extract, p. 4).—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 261;—Thirteenth Ann. Rep. N. Y. State Geologist, 1895, p. 851.

Obs. It is unfortunate that Rensselæria johanni is the type for two generic names. Adhering strictly to the rules of nomenclature Rensselandia will take precedence over Newberrya. The first term is, however, improperly constructed and is without meaning.

Newberrya claypolei Hall. Hamilton (Dev.).

Rensselæria marylandica? Claypole, Proc. American Phil. Soc., 1883, p. 235.

Newberria claypolii Hall, Tenth Ann. Rep. N. Y. State Geol., 1891, p. 9, extract, pl. 5, figs. 1-9.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 263, pl. 78, figs. 1-9.

Loc. Perry County, Pennsylvania.

Newberria? condoni McChesney=Megalanteris condoni.

Newberrya johannis Hall. Middle Devonian.

Rensselæria? johanni Hall, Pal. New York, IV, 1867, p. 385, pl. 58A, figs. 9-20.

Rensselandia johanni Hall, Ibidem, 1867, at end of description.

Newberria johanni Hall, Cont. Canadian Pal., I, 1891, p. 237.

Newberria johannis Hall, Tenth Ann. Rep. N. Y. State Geol., 1891, p. 8, extract, pl. 6, figs. 1-11.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 262, pl. 78, figs. 10-16.

Loc. Waterloo, Iowa.

Newberrya lævis (Meek). Middle Devonian.

Rensselæria lævis Meek, Trans. Chicago Acad. Sci., I, 1868, p. 108, pl. 13, fig. 8; pl. 14, fig. 4.

Newberria lævis Hall, Cont. Canadian Pal., I, 1891, p. 237, pl. 30, figs. 3, 4.

Newberria lævis Hall, Tenth Ann. Rep. N. Y. State Geol., 1891, p. 7, extract, pl. 6, figs. 12-15.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 264, pl. 78, figs. 17-20.

Loc. Mackenzie, Onion, and Lockhart rivers, Canada.

Newberrya missouriensis Swallow. Hamilton (Dev.).

Newberria missouriensis (Swallow MS.) Hall, Tenth Ann. Rep. N. Y. State Geol., 1891, p. 9, extract, pl. 5, figs. 10-12.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 263, pl. 78, figs. 21-23.

Loc. Moniteau County, Missouri.

NOTOTHYRIS Waagen, Genotype Terebratula subvesicularis David.

Notothyris Waagen, Palæontologica Indica, Ser. XIII, I, 1882, p. 375.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 274;—Thirteenth Ann. Rep. N. Y. State Geologist, 1895, p. 857.

Notothyris (?) smithii Derby. Middle Devonian.

Notothyris (?) smithii Derby, Archivos do Museu Nacional do Rio De Janeiro, IX, 1890, p. 81.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pp. 267, 275.

Loc. Head of the Paraguay in Matto-Grosso, Brazil.

NUCLEOSPIRA Hall. Genotype Spirifer ventricosa Hall.

Nucleospira Hall, Twelfth Rep. N. Y. State Cab. Nat. Hist., 1859, p. 24;—Pal. New York, III, 1859, p. 219;—Ibidem, IV, 1867, p. 278.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 103.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 142;—Thirteenth Ann. Rep. N. Y. State Geologist, 1895, p. 806.

Nucleospira barrisi White. Kinderhook (L. Carb.).

Nucleospira barrisi White, Jour. Boston Soc. Nat. Hist., VIII, 1860, p. 227.

Loc. Burlington, Iowa.

Nucleospira concentrica Hall. Lower Helderberg (Dev.).

Nucleospira concentrica Hall, Pal. New York, III, 1859, p. 223, pl. 28B, figs. 15-19.—Hall and Clarke, Ibidem, VIII, Pt. II, 1895, pl. 48, fig. 7.

Loc. Decatur County, Tennessee.

Nucleospira concinna Hall. Corniferous-Hamilton (Dev.).

Atrypa concinna Hall, Geol. N. Y.; Rep. Fourth Dist., 1843, p. 200, fig. 3.

Nucleospira concinna Hall, Twelfth Rep. N. Y. State Cab. Nat. Hist., 1859, pp. 25, 26;—Pal. New York, IV, 1867, p. 279, pl. 45, figs. 33–57.—Davidson, Suppl. British Silurian Brach., Palæontographical Society, 1882, p. 121.—Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 147.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 103, pl. 32, figs. 1–4.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 145, fig. 131; pl. 48, figs. 12–17, 19–34; pl. 84, fig. 38.

Loc. Moscow, Darien, etc., New York; Monroe County, Pennsylvania; Thedford, Ontario; Hardy County, Virginia; Columbus, Ohio; Falls of Ohio; Lone Mountain, Nevada.

Nucleospira elegans Hall. ?Niagara and L. Helderberg (Sil. and Dev.).

Nucleospira elegans Hall, Pal. New York, III, 1859, p. 222, pl. 28B, figs. 10–15.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 104.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 48, figs. 8–11.

Loc. Cherry Valley, New York; Cumberland, Maryland. In the Niagara near Louisville, Kentucky (Nettelroth).

Nucleospira indianensis Miller=Parazyga hirsuta.

Nucleospira pisiformis Hall. Niagara (Sil.).

Orthis pisum Hall (non Sowerby), Pal. New York, II, 1852, p. 250, pl. 2, fig. 1.

Nucleospira pisiformis Hall, Pal. New York, III, 1859, pl. 28B;—Trans. Albany Institute, IV, 1863, p. 226;—Twenty-eighth Rep. N. Y. State Mus. Nat. Hist., 1879, p. 160, pl. 25, figs. 22–28;—Eleventh Rep. State Geol. Indiana, 1882, p. 301, pl. 25, figs. 22–28.—Kayser, Richthofens China, IV, 1883, p. 47, pl. 4, figs. 9–11.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 104, pl. 33, figs. 7–9.—Keyes, Geol. Survey Missouri, V, 1895, p. 94, pl. 41, fig. 5.

Loc. Wolcott, New York; Waldron, Indiana; Louisville, Kentucky; Pike County, Missouri; Tshau-Tien, China.

Nucleospira rotundata Whitfield. Waterlime (Sil.).

Nucleospira rotundata Whitfield, Ann. New York Acad. Sci., II, 1882, p. 194;—Ibidem, V, 1891, p. 511, pl. 5, figs. 11–14;—Geol. Ohio, VII, 1895, p. 413, pl. 1, figs. 11–14.

Loc. Greenfield, Ohio.

Nucleospira ventricosa Hall. Lower Helderberg (Dev.).

Spirifer ventricosa Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 57.

Nucleospira ventricosa Hall, Pal. New York, III, 1859, p. 220, pl. 14, fig. 1; pl. 28B, figs. 2–9.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 145, figs. 128–130; pl. 48, figs. 2–6, 18; pl. 84, figs. 39, 40.

Loc. Schoharie, Cherry Valley, etc., New York; Cumberland, Maryland.

OBOLELLA Billings. Genotype O. chromatica Billings.

Obolella Billings, Geol. Vermont, II, 1861, p. 946;—Pal. Fossils, I, 1861, p. 7.—Hall, Sixteenth Rep. N. Y. State Cab. Nat. Hist., 1863, p. 131.—Meek and Hayden, Smithsonian Cont. to Knowledge, XIV, 172, 1864, p. 3.—Hall, Trans. Albany Institute, V, 1867, p. 108.—Dall, American Jour. Conchology, VI, 1870, pp. 162, 164.—Billings, Canadian Nat. Geol., n. ser., VI, 1871, p. 217, figs. 5, 6;—American Jour. Sci., 3d ser., III, 1872, p. 355, figs. 5–7;—Ibidem, 3d ser., XI, 1876, p. 176.—Ford, Ibidem, 3d ser., XXI, 1881, p. 131.—Walcott, Bull. U. S. Geol. Survey, 30, 1886, p. 109.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 66, 164;—Eleventh Ann. Rep. N. Y. State Geologist, 1894,

OBOLELLA Billings—Continued.

p. 240.—Matthew, Trans. Royal Soc. Canada, IX, 1892, p. 39.—Mickwitz, Mém. l'Acad. Imp. Sci. St. Pétersbourg, VIII, 1896, p. 116.

Dicellomus Hall, Twenty-third Rep. N. Y. State Cab. Nat Hist., 1873, p. 246.

Obolella ambigua Walcott=Elkania ambigua.

Obolella atlantica Walcott. Lower Cambrian.

Obolella atlantica Walcott, Proc. U. S. Nat. Mus., XII, 1889, p. 36;—Tenth Ann. Rep. U. S. Geol. Survey, 1891, p. 611, pl. 71, fig. 1.

Loc. Conception Bay, Newfoundland; Attleboro, Massachusetts.

Obolella cælata Billings=Lingulella cælata.

Obolella chromatica Billings. Lower Cambrian.

Obolella chromatica Billings, Geol. Vermont, II, 1861, p. 947, fig. 346;—Pal. Fossils, I, 1861, p. 7, fig. 7;—Geol. Canada, 1863, p. 284, fig. 288.—Hall, Trans. Albany Institute, V, 1867, p. 110.—Billings, American. Jour. Sci., 3d ser., XI, 1876, p. 176, figs. 1-4.—Ford, Ibidem, 3d ser., XXI, 1881, p. 133, figs. 3, 4, 5.—Walcott, Bull. U. S. Geol. Survey, 30, 1886, p. 112, pl. 11, fig. 1;—Tenth Ann. Rep. U. S. Geol. Survey, p. 611, pl. 71, fig. 2.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 70.

Loc. Anse au Loup, Canada.

Obolella cingulata Billings=Kutorgina cingulata.

Obolella circe Billings. Lower Cambrian.

Obolella circe Billings, Canadian Nat. Geol., n. ser., IV, 1871, p. 218;—American Jour. Sci., III, 1872, p. 357.—Walcott, Bull. U. S. Geol. Survey, 30, 1886, p. 118, pl. 10, fig. 3;—Tenth Ann. Rep. U. S. Geol. Survey, 1891, p. 611, pl. 71, fig. 3.

Loc. Trois Pistoles, Canada.

Obolella crassa (Hall). Lower Cambrian.

Orbicula? crassa Hall, Pal. New York, I, 1847, p. 290, pl. 79, fig. 8.

Avicula? desquamata Hall, Ibidem, 1847, p. 292, pl. 80, fig. 2.

Obolella crassa Billings, Canadian Nat. Geol., n. ser., VI, 1871, p. 218.—Ford, Amer. Jour. Sci., 3d ser., XV, 1878, p. 128;—Ibidem, 3d ser., XXI, 1881, p. 131, figs. 1, 2.—Walcott, Bull. U. S. Geol. Survey, 30, 1886, p. 114, pl. 10, fig. 1.—Shaler and Foerste, Bull. Mus. Comp. Zool., XVI, 1888, p. 27, pl. 1, fig. 1.—Walcott, Tenth Ann. Rep. U. S. Geol. Survey, 1891, p. 612, pl. 71, fig. 4.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 70, pl. 2, figs. 31-36.

Obolella desquamata Billings, Canadian Nat. Geol., n. ser., VI, 1871, p. 217, fig. 6;—American Jour. Sci., 3d ser., III, 1872, p. 355, fig. 6.

Obolella (Orbicula?) crassa Ford, American Jour. Sci., 3d ser., II, 1871, p. 33.

Dicellomus crassa Hall, Twenty-third Rep. N. Y. State Cab. Nat. Hist., 1873, p. 246, pl. 13, figs. 6-9.

Obolella chromatica (lap. crassa) Walcott, American Jour. Sci., 3d ser., XXIX, 1885, p. 116, figs. 1, 2;—Ibidem, XXX, 1890, p. 21.

Loc. Troy and Schodack Landing, New York; North Attleboro, Massachusetts; St. Simon and Bic Harbor, below Quebec, Canada.

Obolella desiderata Billings=Elkania desiderata.

Obolella desquamata Billings=Obolella crassa.

Obolella (?) discoidea Hall and Whitfield. Up. Camb. and Pogonip (Ord.).

Obolella discoidea Hall and Whitfield, King's U. S. Geol. Expl. 40th Parl., IV, 1877, p. 203, pl. 1, figs. 1, 2.—Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 14.

Obolella? discoidea Walcott, Bull. U. S. Geol. Survey, 30, 1886, p. 111.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 69.

Loc. Eureka district, Nevada.

Obolella gemma Billings. Lower Cambrian.

Obolella gemma Billings, Canadian Nat. Geol., n. ser., VI, 1871, p. 217, fig. 5;—American Jour. Sci., 3d ser., III, 1872, p. 357, fig. 5.—Walcott, Bull. U. S. Geol. Survey, 30, 1886, p. 116, pl. 10, fig. 2;—Tenth Ann. Rep. U. S. Geol. Survey, 1891, p. 612, pl. 71, fig. 5; pl. 72, fig. 2.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 71, fig. 30; pl. 2, figs. 42–44.

Loc. Bic and St. Simon harbors, below Quebec, Canada; Troy, New York.

Obolella (?) gemmula Matthew. Upper Cambrian.

Obolella (?) gemmula Matthew, Trans. Royal Soc. Canada, IX, 1892, p. 41, pl. 12, figs. 8a–8c.

Loc. Near St. John, New Brunswick.

Obolella (?) ida Billings. Upper Cambrian and Calciferous (Ord.).

Obolella ida Billings, Pal. Fossils, I, 1862, p. 71, fig. 63, on p. 68.

Obolella ? ida Walcott, Bull. U. S. Geol. Survey, 30, 1886, p. 111.

Loc. Point Levis, Canada.

Obolella misera Billings=Linnarssonia misera.

Obolella minuta (Hall and Whitfield). Upper Cambrian.

Lingulepis ? minuta Hall and Whitfield, Rep. Geol. Expl. 40th Parl., IV, 1877, p. 206, pl. 1, figs. 3, 4.—Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 13.

Loc. Eureka district, Nevada.

Obolella nana Meek and Hayden. Middle Cambrian.

Obolella nana Meek and Hayden, Proc. Acad. Nat. Sci. Philadelphia, 1861, p. 435.—Billings, Pal. Fossils, I, 1862, p. 67.—Hayden, American Jour. Sci., 2d ser., XXXIII, 1863, p. 73.—Meek and Hayden, Smithsonian Cont. to Knowledge, XIV, 172, 1864, p. 4, pl. 1, fig. 3.—Whitfield, Powell's Geol. Geogr. Survey Rocky Mountain Region, 1880, p. 340, pl. 2, figs. 14–17.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 69.

Loc. Black Hills, South Dakota.

Obolella nitida Ford. Lower Cambrian.

Obolella nitida Ford, American Jour. Sci., 3d ser., V, 1873, p. 213.—Walcott, Bull. U. S. Geol. Survey, 30, 1886, p. 118, pl. 11, fig. 2;—Tenth Ann. Rep. U. S. Geol. Survey, 1891, p. 612, pl. 72, fig. 1.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 69, 70.—?Matthew, Trans. N. Y. Acad. Sci., XIV, 1895, p. 125, pl. 2, fig. 8.

Loc. Troy, and Washington County, New York; Hanford Brook, New Brunswick.

Obolella pectenoides (Whitfield). Upper Cambrian.

Obolus pectenoides Whitfield, Ludlow's Rep. Reconn. Black Hills, Dakota, 1875, p. 103, figs. 1–3.

Obolus? pectenoides Whitfield, Powell's Geol. Geogr. Survey Rocky Mountain Region, 1880, p. 338, pl. 2, figs. 18, 19.

Loc. Black Hills, South Dakota.

Obolella polita Hall. Middle Cambrian.

Obolus appolinus Owen (non Eichwald), Geol. Survey Wisconsin, Iowa, Minnesota, 1852, pl. 1B, figs. 9, 11, 15, 20.

Lingula? polita Hall, Ann. Rep. Geol. Survey Wisconsin, 1861, p. 24;—Geol. Rep. Wisconsin, I, 1862, pp. 21, 435.

Obolella ? polita Hall, Sixteenth Rep. N. Y. State Cab. Nat. Hist., 1863, p. 133, pl. 6, figs. 17–21;—Trans. Albany Institute, V, 1867, p. 112.

Lingulepis prima Meek and Hayden, Smithsonian Cont. to Knowl., XIV, 172, 1864, p. 3, pl. 1, fig. 2.

Dicellomus polita Hall, Twenty-third Rep. N. Y. State Cab. Nat. Hist., 1873, p. 246.

Obolella polita Hall—Continued.

Obolella polita Whitfield, Powell's Geol. Geogr. Survey Rocky Mountain Region, 1880, p. 339, pl. 2, figs. 12, 13.—Walcott, Bull. U. S. Geol. Survey, 30, 1886, p. 111.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 2, figs. 37–41.

Loc. Trempealeau, Wisconsin; Black Hills, South Dakota.

Obolella pretiosa Billings=Linnarssonia pretiosa.

Obolella prima Whitfield=Lingulepis prima.

Obolella transversa Hartt=Linnarssonia transversa.

Obolellina Billings=Dinobolus.

Obolellina canadensis Billings=Dinobolus canadaensis.

Obolellina galtensis Billings=Rhinobolus galtensis.

Obolellina magnifica Billings=Dinobolus magnificus.

OBOLUS Eichwald. Genotype Obolus appolinus Eichwald.

Obolus Eichwald, Zoologia Specialis, I, 1829, p. 274.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 80, figs. 33, 34; pp. 164, 337.—Matthew, Trans. Royal Soc. Canada, IX, 1892, p. 43.—Mickwitz, Mém. l'Acad. Imp. Sci. St. Pétersbourg, VIII, 1896, pp. 25, 126.

Euobolus Mickwitz, Mém. l'Acad. Imp. Sci. St. Pétersbourg, VIII, 1896, pp. 25, 129, 133.

Obs. Both Euobolus and Obolus are based upon the same species.

Obolus appolinus Owen (non Eichwald)=Obolella polita.

Obolus canadensis Billings, 1858=Dinobolus magnificus.

Obolus canadensis Billings=Dinobolus canadaensis.

Obolus conradi Hall=Dinobolus conradi.

Obolus galtensis Billings=Rhinobolus galtensis.

Obolus labradoricus Billings=Iphidea labradorica.

Obolus (?) major Matthew. Lower Cambrian.

Obolus? major Matthew, Trans. Royal Soc. Canada, IV, 1890, p. 155, pl. 8, fig. 3.

Mickwitzia (?) major Mickwitz, Mém. l'Acad. Imp. Sci. St. Pétersbourg, VIII, 1896, p. 23.

Loc. Near St. John, New Brunswick.

Obolus (?) murrayi Billings. Cambrian.

Obolus? murrayi Billings, Pal. Fossils, I, 1865, p. 362.

Loc. Hare Bay, Newfoundland.

Obolus ? pectenoides Whitfield=Obolella pectinoides.

Obolus pulcher Matthew=Botsfordia pulchra.

Obolus pristinus Matthew. ?Middle Cambrian.

Obolus pristinus Matthew, Trans. N. Y. Acad. Sci., XIV, 1895, p. 121, pl. 4, fig. 1.

Loc. Hanford Brook, New Brunswick.

Obolus (?) refulgens Matthew. Middle Cambrian.

Obolus refulgens Matthew, Trans. Royal Soc. Canada, IX, 1892, p. 44, pl. 12, figs. 6a–6d.

Obolus (?) refulgens Mickwitz, Mém. l'Acad. Imp. Sci. St. Pétersbourg, VIII, 1896, p. 23.

Loc. Near St. John, New Brunswick.

Œhlertella Hall and Clarke=Lingulodiscina.

Orbicula Cuvier=Crania.

Orbicula Sowerby, 1830=Discina.

Orbicula cælata Hall=Lingulella cælata.

Orbicula corrugata Hall=Lichenalia, a bryozoan.
Orbicula crassa Hall=Obolella crassa.
Orbicula deformata Hall=Crania deformata.

?Orbicula excentrica Emmons. Cambrian.

Orbicula excentrica Emmons, American Geology, Pt. II, 1855, p. 112, pl. 1, fig. 4.
Crania excentrica Miller, N. American Geol. Pal., 1889, p. 341.
Loc. Augusta County, Virginia.
Obs. Probably a gastropod.

Orbicula filosa Hall=Schizocrania filosa.
Orbicula grandis Vanuxem=Rœmerella grandis.
Orbicula lamellosa Hall (non Broderip)=Orbiculoidea lamellosa.
Orbicula lodensis Vanuxem=Orbiculoidea lodiensis.
Orbicula lugubris Conrad=Discinisca lugubris.
Orbicula minuta Hall=Orbiculoidea minuta.
Orbicula multilineata Conrad=Discinisca multilineata.
Orbicula parmulata Hall=Orbiculoidea parmulata.
Orbicula prima Owen=Lingulepis pinniformis.
Orbicula squamiformis Hall=Pholidops squamiformis.
Orbicula subtruncata Hall=Pholidops subtruncata.
Orbicula tenuilamellata Hall=Schizotreta tenuilamellata.
Orbicula terminalis Emmons=Trematis terminalis.
Orbicula truncata Emmons=Orbiculoidea lamellosa.

ORBICULOIDEA d'Orbigny. Genotype Orbicula morrisi Davidson.

Orbiculoidea d'Orbigny, Prodrome de Paléontologie stratigraphique, I, 1850, p. 44.—Dall, Bull. Mus. Comp. Zool., III, 1871, p. 37;—American Jour. Conch., VII, 1871, p. 74.—Herrick, Bull. Denison Univ., IV, 1888, p. 12.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 125, fig. 64; p. 128, fig. 160 and pp. 160, 168.—Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 363.—Hall and Clarke, Eleventh Ann. Rep. N. Y. State Geologist, 1894, p. 256.
Discina Hall (non Lamarck), Pal. New York, III, 1859, p. 159;—Sixteenth Rep. N. Y. State Cab. Nat. Hist., 1863, p. 130;—Pal. New York, IV, 1867, p. 15.

Orbiculoidea alleghania (Hall). Chemung (Dev.).

Discina alleghania Hall, Thirteenth Rep. N. Y. State Cab. Nat. Hist., 1860, p. 77, figs. 1, 2;—Pal. New York, IV, 1867, p. 25, fig. 1, pl. 1, fig. 17.
Loc. Hobbieville, Alleghany County, New York.

Orbiculoidea ampla Hall. Oriskany (Dev.).

Discina grandis Hall (non Vanuxem, 1842), Pal. New York, III, 1859, p. 406, pl. 92, fig. 1.
Discina ampla Hall, Ibidem, corrigenda in volume with plates, 1859.
Orbiculoidea ampla Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 127.
Loc. Albany County, New York; Cayuga, Ontario.

Orbiculoidea baini (Morris and Sharpe.) Middle Devonian.

Orbicula baini Morris and Sharpe, Quart. Jour. Geol. Soc. London, II, 1846, p. 277, pl. 10, fig. 5.—Sharpe and Salter, Trans. Geol. Soc. London, 2d ser., VII, 1856, p. 210, pl. 26, figs. 20–23.
Discina baini von Ammon, Zeits. Gessels. für Erdk., Berlin, XXVIII, 1893, p. 359, fig. 4.
Loc. Falkland Islands; Taquarassu, Matto-Grosso, Brazil; South Africa.

Orbiculoidea (?) capax (White). Kinderhook (L. Carb.).

Discina capax White, Proc. Boston Soc. Nat. Hist., IX, 1862, p. 30.—A. Winchell, Proc. Acad. Nat. Sci. Philadelphia, 1865, p. 112;—Proc. American Phil. Soc., XII, 1870, p. 249.

Loc. Burlington, Iowa; Girard and Rockville, Ohio (A. Winchell).

Obs. This species should be compared with Lingulodiscina newberryi Hall.

Orbiculoidea capuliformis (McChesney). Upper Carboniferous.

Discina capuliforma McChesney, New Pal. Fossils, 1860, p. 72;—Trans. Chicago Acad. Sci., I, 1868, p. 73, pl. 2, fig. 20.

Loc. Springfield, Illinois.

Obs. Compare with O. convexa Shumard.

Orbiculoidea conica Dwight=Schizotreta conica.

Orbiculoidea conradi (Hall). Lower Helderberg (Dev.).

Discina conradi Hall, Pal. New York, III, 1859, p. 161, pl. 9, figs. 16, 17; pl. 10A, fig. 2.

Loc. Near Hudson, New York.

Orbiculoidea convexa (Shumard). Upper Carboniferous.

Discina convexa Shumard, Trans. St. Loius Acad. Sci., I, 1858, p. 221.—White, Thirteenth Rep. State Geol. Indiana, 1884, p. 121, pl. 25, fig. 9.—Herrick, Bull. Denison Univ., II, 1887, pl. 3, fig. 19.—Keyes, Geol. Survey Missouri, V, 1895, p. 40, pl. 35, fig. 7.

Loc. Valley of Verdigris River, Kansas; Kansas City, Missouri; Vermilion County, Indiana; Newark, Ohio.

Obs. See Orbiculoidea capuliformis McChesney.

Orbiculoidea discus Hall. Lower Helderberg (Dev.).

Discina discus Hall, Pal. New York, III, 1859, p. 159, pl. 9, figs. 13–15.

Schizocrania (?) discus Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 132.

Orbiculoidea discus Hall and Clarke, Ibidem, 1892, pl. 4E, fig. 13.

Loc. Near Hudson and Albany counties, New York.

Orbiculoidea doria (Hall). Hamilton (Dev.).

Discina doria Hall, Sixteenth Rep. N. Y. State Cab. Nat. Hist., 1863, p. 26;—Pal. New York, IV, 1867, p. 19, pl. 2, figs. 19–22, 31 (?30).—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 32.

Loc. Madison County, New York; Thedford, Ontario; Clark County, Indiana.

Orbiculoidea elmira (Hall). Chemung (Dev.).

Discina elmira Hall, Sixteenth Rep. N. Y. State Cab. Nat. Hist., 1863, p. 29;—Pal. New York, IV, 1867, p. 24, pl. 2, figs. 38, 39.

Loc. Elmira, New York; Wellsboro, Pennsylvania.

Orbiculoidea gallaheri (A. Winchell). Marshall (L. Carb.).

Discina gallaheri A. Winchell, Proc. Acad. Nat. Sci. Philadelphia, 1865, p. 112;—Proc. American Philosophical Soc., XII, 1870, p. 249.

Loc. Hillsdale, Michigan; Granville, Ohio; Shafers, Pennsylvania.

Orbiculoidea herzeri Hall and Clarke. Waverly (L. Carb.).

Orbiculoidea herzeri Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 126, 127, 178.

Orbiculoidea pulchra Hall and Clarke, Ibidem, 1892, pl. 4E, fig. 19; pl. 4F, figs. 9–13, 30, (?14–16).

Loc. Berea and Baconsburg, Ohio; Meadville, Pennsylvania.

Orbiculoidea humilis (Hall). Marcellus and Hamilton (Dev.).

Discina humilis Hall, Sixteenth Rep. N. Y. State Cab. Nat. Hist., 1863, p. 25;—Pal. New York, IV, 1867, p. 16, pl. 2, fig. 18.—Whitfield, Annals N. Y. Acad. Sci., V, 1891, p. 560;—Geol. Ohio, VII, 1895, p. 452, pl. 8, figs. 1, 2.

Loc. Bridgewater, Canandaigua Lake, etc., New York; Leroy, Ohio.

Orbiculoidea illinoisensis (Miller and Gurley). Upper Carboniferous.

Discina illinoiensis Miller and Gurley, Bull. Illinois State Mus. Nat. Hist., 3, 1893, p. 70, pl. 7, figs. 2–5.

Loc. Knox and Peoria counties, Illinois.

Obs. Closely related to O. convexa.

Orbiculoidea jervisensis (Barrett). Oriskany (Dev.).

Discina jervensis Barrett, Annals N. Y. Acad. Sci., I, 1878, p. 121.

Loc. Port Jervis, New York.

Orbiculoidea keokuk (Gurley). Keokuk (L. Carb.).

Discina keokuk Gurley, New Carb. Fossils, 1884, p. 6.

Loc. Crawfordsville, Indiana.

Orbiculoidea lamellosa Hall. Trenton and Lorraine (Ord.).

Orbicula lamellosa Hall (non Broderip, 1833), Pal. New York, I, 1847, p. 99, pl. 30, fig. 10.

Orbicula truncata Emmons, American Geology, Pt. II, 1855, p. 200, fig. 62.

Discina truncata Emmons, Manual of Geol., 1860, p. 99.

Orbiculoidea lamellosa? Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 364, pl. 29, fig. 25.

Orbiculoidea lamellosa Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 4E, fig. 12.

Discina circe Billings, Pal. Fossils, I, 1862, p. 51, fig. 55;—Geol. Canada, 1863, p. 159, fig. 125.

Loc. Middleville and Lowville, New York; Bellville and Ottawa, Canada; Spring Valley, Minnesota.

Obs. Orbicula lamellosa Broderip, is the type species of Discinisca, and Hall's name will therefore stand.

Orbiculoidea lodiensis (Vanuxem). Genesee (Dev.).

Orbicula lodensis Vanuxem, Geol. N. Y.; Rep. Third Dist., 1842, p. 168, fig. 1.—Hall, Ibidem, Rep. Fourth Dist., 1843, p. 223, fig. 1.

Discina lodensis Hall, Pal. New York, IV, 1867, p. 22, pl. 1, fig. 14; pl. 2, fig. 35.—Rathbun, Bull. Buffalo Soc. Nat. Sci., I, 1874, p. 257;—Proc. Boston Soc. Nat. Hist., XX, 1879, p. 17.—Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 112, pl. 2, fig. 5.—Clarke, Bull. U. S. Geol. Survey, 16, 1885, p. 24.—Whitfield, Annals N. Y. Acad. Sci., V, 1891, p. 547, pl. 11, fig. 7;—Geol. Ohio, VII, 1895, p. 442, pl. 7, fig. 7.

Discina sp. a A. Ulrich, N. Jahrb. für Mineral., Beilageband, VIII, 1892, p. 81, pl. 5, fig. 10.

Orbiculoidea lodensis Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 4F, fig. 21.

Loc. Lodi, etc., New York; White Pine district, Nevada; Erere, Province of Para, Brazil; Chahuarani, Bolivia. In the Marcellus shale of Delaware County, Ohio (Whitfield).

Orbiculoidea lodiensis media Hall. Marcellus-Chemung (Dev.).

Discina media Hall, Sixteenth Rep. N. Y. State Cab. Nat. Hist., 1863, p. 27;—Pal. New York, IV, 1867, p. 20, pl. 2, figs. 25–29.—Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 113.

Orbiculoidea media Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 4E, figs. 15–17.

Loc. Seneca and Canandaigua lakes, New York; Chemung group, Troupsburg, New York.

Orbiculoidea magnifica (Herrick). Waverly (L. Carb.).

Discina magnifica Herrick, Bull. Geol. Soc. America, II, 1891, p. 46, pl. 1, fig. 17.

Loc. Wooster, and Ashland County, Ohio.

Orbiculoidea manhattanensis (Meek and Hayden). Upper Carboniferous.

Discina manhattensis Meek and Hayden, Proc. Acad. Nat. Sci. Philadelphia, 1859, p. 25.

Loc. Near Manhattan, Kansas.

Orbiculoidea marginalis (Whitfield). Hamilton (Dev.).

Discina marginalis Whitfield, Ann. Rep. Geol. Survey Wisconsin, 1880, p. 70;—Geol. Survey Wisconsin, IV, 1882, p. 325, pl. 25, fig. 11.

Orbiculoidea marginalis Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 127, pl. 4F, fig. 17.

Loc. Milwaukee, Wisconsin.

Orbiculoidea minuta (Hall). Marcellus-Hamilton (Dev.).

Orbicula minuta Hall, Geol. N. Y. ; Rep. Fourth Dist., 1843, p. 180, fig. 9.

Discina minuta Hall, Pal. New York, IV, 1867, p. 16, pl. 1, fig. 16.—Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 112, pl. 13, fig. 5.—Whitfield, Annals N. Y. Acad. Sci., V, 1891, p. 547, pl. 11, figs. 5, 6;—Geol. Ohio, VII, 1895, p. 442, pl. 7, figs. 5, 6.

Orbiculoidea minuta Beecher, American Jour. Sci., 3d ser., XLI, 1891, p. 356, pl. 17, figs. 5–7;—American Jour. Sci., 3d ser., XLIV, 1892, p. 150, pl. 1, figs. 4–6.

Loc. Avon, New York; Delaware County, Ohio; near Eureka, Nevada.

Orbiculoidea missouriensis (Shumard). Upper Carboniferous.

Discina missouriensis Shumard, Trans. St. Louis Acad. Sci., I, 1858, p. 221.

Discina nitida? Meek and Worthen (non Phillips), Geol. Survey Illinois, V, 1873, p. 572, pl. 25, fig. 1.

Discina nitida White, Thirteenth Rep. State Geologist Indiana, 1884, p. 121, pl. 25, fig. 10.—Keyes, Proc. Acad. Nat. Sci. Philadelphia, 1888, p. 226.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 131, pl. 4F, figs. 23–28.—Keyes, Geol. Survey Missouri, V, 1895, p. 39, pl. 35, fig. 6.

Discina meekana Whitfield, Annals N. Y. Acad. Sci., II, 1882, p. 228.—Herrick, Bull. Denison Univ., II, 1887, p. 145, pl. 2, fig. 8.—Whitfield, Annals N. Y. Acad. Sci., V, 1891, p. 598, pl. 15, figs. 1–3;—Geol. Ohio, VII, 1895, p. 483, pl. 11, figs. 1–3.

Loc. Lexington, Missouri; Illinois; Carbon Hill and Flint Ridge, Ohio; Des Moines, Iowa; Vermilion County, Indiana.

Obs. This species is not D. nitida Phillips. It differs from it in form and in the muscular scars.

Orbiculoidea (?) munda (Miller and Gurley). Upper Carboniferous.

Discina munda Miller and Gurley, Bull. Illinois State Mus. Nat. Hist., 3, 1893, p. 71, pl. 7, figs. 6, 7.

Loc. Kansas City, Missouri.

Obs. This species may be a Lingulodiscina, but since the ventral valve is unknown satisfactory generic reference can not be made.

Orbiculoidea neglecta (Hall). Chemung (Dev.).

Discina neglecta Hall, Sixteenth Rep. N. Y. State Cab. Nat. Hist., 1863, p. 29;—Pal. New York, IV, 1867, p. 24, pl. 1, figs. 12, 13.

Loc. Ithaca, New York.

Orbiculoidea newberryi Meek=Lingulodiscina newberryi.

Orbiculoidea nitida (Phillips). Upper Carboniferous.

Orbicula nitida Phillips, Geol. Yorkshire, II, 1836, p. 221, pl. 9, figs. 10–13.

†Discina nitida Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 213, pl. 7, fig. 4.

Loc. England; White Pine district, Nevada.

Orbiculoidea numulus Hall and Clarke. Waterlime (Sil.).
Orbiculoidea numulus Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 178, pl. 4E, fig. 14.
Loc. Marshall, New York.

Orbiculoidea parmulata (Hall). Medina (Sil.).
Orbicula parmulata Hall, Geol. New York; Rep. Fourth Dist., 1843, p. 48, fig. 4;—Pal. New York, II, 1852, pl. 4, fig. 3.
Loc. Medina and Lockport, New York.

Orbiculoidea patellaris (A. Winchell). Kinderhook (L. Carb.).
Discina patellaris A. Winchell, Proc. Acad. Nat. Sci. Philadelphia, 1863, p. 4.
Loc. Burlington, Iowa.

Orbiculoidea pleurites Meek=Lingulodiscina pleurites.

Orbiculoidea pulchra Hall=Orbiculoidea hertzeri.

Orbiculoidea randalli Hall. Hamilton (Dev.).
Discina randalli Hall, Sixteenth Rep. N. Y. State Cab. Nat. Hist., 1863, p. 25;—Pal. New York, IV, 1867, p. 18, pl. 2, fig. 34.
Orbiculoidea randalli Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 4E, fig. 18.
Loc. Schoharie, New York.

Orbiculoidea saffordi (A. Winchell). Lower Carboniferous.
Discina saffordi A. Winchell, Geol. Tennessee, 1869, p. 443;—Proc. American Philosophical Soc., XII, 1870, p. 248.
Loc. "Just above Black Slate," Hickman County, Tennessee.

Orbiculoidea sampsoni (Miller). Chouteau (L. Carb.).
Discina sampsoni Miller, Seventeenth Rep. State Geol. Indiana, 1891, p. 80, pl. 13, figs. 10–12.
Loc. Sedalia, Missouri.

Orbiculoidea seneca (Hall). Hamilton (Dev.).
Discina seneca Hall, Sixteenth Rep. N. Y. State Cab. Nat. Hist., 1863, p. 26;—Pal. New York, IV, 1867, p. 20, pl. 2, figs. 23, 24.
Loc. East shore of Seneca Lake, New York.

Orbiculoidea subplana (Hall). Arisaig (Sil.).
Discina tenuilamellata var. subplana Hall, Canadian Nat. Geol., V, 1860, p. 144.—Dawson, Acadian Geol., 3d ed., 1878, p. 595.
Loc. Arisaig, Nova Scotia.

Orbiculoidea subtrigonalis (McChesney). Upper Carboniferous.
Discina subtrigonalis McChesney, New Pal. Fossils, 1865, p. 97.
Discina trigonalis McChesney, Ibidem, 1865, pl. 2, fig. 19;—Trans. Chicago Acad. Sci., I, 1868, p. 24, pl. 2, fig. 19.
Loc. Lasalle, Illinois.

Orbiculoidea tenuilineata (Meek and Hayden). Upper Carboniferous.
Discina tenuilineata Meek and Hayden, Proc. Acad. Nat. Sci. Philadelphia, 1859, p. 25.
Loc. Cottonwood Creek, Kansas.

Orbiculoidea tenuistriata (Ulrich). Utica (Ord.).
Discina tenuistriata Ulrich, Jour. Cincinnati Soc. Nat. Hist., I, 1878, p. 96, pl. 4, fig. 10.
Loc. Covington, Kentucky.

Orbiculoidea tullia (Hall). Tully (Dev.).

Discina tullia Hall, Sixteenth Rep. N. Y. State Cab. Nat. Hist., 1863, p. 28;—Pal. New York, IV, 1867, p. 22, pl. 2, figs. 16, 17.

Loc. Seneca Lake, New York.

Orbiculoidea utahensis (Meek). Upper Carboniferous.

Discina sp. undet., Meek, King's U. S. Geol. Expl. 40th Parl., IV, 1877, p. 99, pl. 10, fig. 3.

Discina utahensis Meek, Ibidem, 1877, p. 99 (also see footnote, p. 9).

Loc. Weber Canyon, Wasatch Range, Utah.

Orbiculoidea vanuxemi (Hall). Arisaig and Waterlime (Sil.).

Discina vanuxemi Hall, Pal. New York, III, 1859, p. 162, pl. 8, fig. 1.

Loc. Manlius-square, New York; Arisaig, Nova Scotia (Ami).

Orbiculoidea varsaviensis (Worthen). Keokuk (L. Carb.).

Discina varsoviensis Worthen, Bull. Illinois State Mus. Nat. Hist., 2, 1884, p. 23;—Geol. Survey Illinois, VIII, 1890, p. 102, pl. 11, fig. 7.

Loc. Warsaw, Illinois.

ORISKANIA Hall and Clarke. Genotype O. navicella H. and C.

Oriskania Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 270;—Thirteenth Ann. Rep. N. Y. State Geologist, 1895, p. 854.

Oriskania navicella Hall and Clarke. Oriskany (Dev.).

Oriskania navicella Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 269, figs. 181–183, pl. 79, figs. 25–27.

Loc. Near Hudson, New York.

ORTHIDIUM Hall and Clarke. Genotype Orthis gemmicula Billings.

Orthidium Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 244;—Eleventh Ann. Rep. N. Y. State Geologist, 1894, p. 276.

Orthidium gemmicula (Billings). Calciferous (Ord.).

Orthis gemmicula Billings, Pal. Fossils, I, 1862, p. 75, fig. 68.

Orthidium gemmicula Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 217, 244, pl. 7A, figs. 22–25.

Loc. Point Levis, Canada.

Orthis of authors.

Orthis Hall, Pal. New York, IV, 1867, p. 33.—Shaler, Fossil Brachiopoda of the Ohio Valley, 1887, p. 18.—Herrick, Bull. Denison University, IV, 1888, p. 14.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 34.—Hall, Bull. Geol. Soc. America, I, 1889, p. 19.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 185, 186;—Eleventh Ann. Rep. N. Y. State Geologist, 1894, p. 264.

ORTHIS Dalman (emend Hall and Clarke).

Genotype Orthis calligramma Dalman.

Orthis Dalman, Kongl. Svenska Vet.-Akad. Handl., för 1827, 1828, pp. 93, 96.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 192.—Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 417.—Hall and Clarke, Eleventh Ann. Rep. State Geologist, 1894, p. 265.

Orthis æquivalvis Hall, 1847=Plectorthis æquivalvis.

Orthis æquivalvis Hall, 1857 (non 1847)=Orthis eryna.

Orthis æquivalvis Shaler (non Hall)=Rhipidomella uberis.

Orthis (?) acuminata Billings. Chazy (Ord.).

Orthis ? acuminata Billings, Canadian Nat. Geol., IV, 1859, p. 440, fig. 19.

Orthis acuminata Billings, Geol. Canada, 1863, p. 130, fig. 59.

Loc. Caughnawaga, Canada.

Orthis acutilirata Meek=Platystrophia acutilirata.
Orthis acutiloba Ringueberg=Bilobites acutilobus.
Orthis alata Shaler=Orthis davidsoni.
Orthis alsus Hall=Rhipidomella alsa.

Orthis (?) alternans Castelnau. Formation.?

Orthis alternans Castelnau, Essai Syst. Sil. l'Amérique Septentrionale, 1843, p. 38, pl. 14, fig. 2.

Loc. "From an erratic block, Lake of the Woods." Undeterminable.

Orthis amœna N. H. Winchell=Dalmanella amœna.
Orthis anticostiensis Shaler=Dinorthis porcata.

Orthis (?) apicalis Billings. ?Upper Cambrian.

Orthis ? apicalis Billings, Pal. Fossils, I, 1865, p. 301, fig. 291.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 217.

Loc. Point Levis and west end of Island of Orleans, Canada.

Orthis arachnoides Roemer and Hall (non Phillips)=Derbya crassa.
Orthis armanda Billings=Syntrophia armanda.
Orthis assimilis Hall=Rhipidomella assimilis.
Orthis aurelia Billings=Plectorthis aurelia.
Orthis aymara Salter=Anoplotheca flabellites.
Orthis barabuensis Winchell=Syntrophia barabuensis.
Orthis battis Billings=Hebertella battis.
Orthis bellarugosa Conrad=Hebertella bellirugosa.
Orthis bellarugosa Hall, 1883=Hebertella insculpta.
Orthis bellula Meek=Dalmanella bellula.

Orthis benedicti Miller. Niagara (Sil.).

Orthis benedicti Miller, Seventeenth Rep. State Geol. Indiana, 1891, p. 78, pl. 13, figs. 7–9.

Loc. Hartsville, Indiana.

Orthis bicostatus Vanuxem=Reticularia bicostata.
Orthis biforata of authors=Platystrophia biforata.
Orthis biforata acutilirata White=Platystrophia acutilirata.
Orthis billingsi Hartt=Billingsella billingsi.
Orthis biloba Hall=Bilobites bilobus.
Orthis bisulcata Emmons=Cyclospira bisulcata.
Orthis borealis Billings=Hebertella borealis.

Orthis(?) buchi d'Orbigny. Upper Carboniferous.

Orthis buchi d'Orbigny, Voyage dans l'Amérique Méridionale, Pal., 1842, p. 49.
Productus andii d'Orbigny, Ibidem, p. 54, pl. 5, figs. 1–3.—de Koninck, Recher. Animaux Foss., Pt. I, 1847, p. 238.

Loc. Yarbichambi, Bolivia.

Orthis calligramma Foerste (non Dalman)=Orthis flabellites.
Orthis calligramma davidsoni Nicholson and Hinde=Orthis davidsoni.

Orthis calligramma Kayser. Lower Ordovician.

Orthis calligramma Kayser (non Davidson), Palæontographica, Suppl., III, 1876, pp. 18, 26, pl. 3, figs. 9–18.

Loc. Cordillere San Juan, Argentine Republic.

Obs. These shells appear to be more closely related to O. plicatella than to O. calligramma.

Orthis canalis Hall=Dalmanella elegantula.
Orthis carbonaria Swallow=Rhipidomella pecosi.
Orthis carinata Hall=Schizophoria carinata.
Orthis carleyi Hall=Dinorthis retrorsa.

Orthis carausii Salter. Calciferous (Ord.).

Orthis carausii (Salter, MS.) Davidson, Geol. Mag. London, V, 1868, p. 315, pl. 16, fig. 23.
Orthis carausii? Matthew, Trans. Royal Soc. Canada, X, 1893, p. 102, pl. 7, fig. 7.
Loc. England; near St. John, New Brunswick.

Orthis (?) centrilineata Hall. Lorraine (Ord.).

Orthis centrilineata Hall, Pal. New York, I, 1847, p. 289, pl. 79, fig. 5*.
Loc. Lorraine and Turin, New York.

Orthis centrosa Miller=Platystrophia crassa.
Orthis charlottæ Winchell=Dinorthis pectinella.
Orthis cincinnatiensis Miller=Orthis? pumila.
Orthis (?) circularis N. H. Winchell=Dalmanella subæquata circularis.
Orthis circulus Hall=Rhipidomella circulus.
Orthis clarkensis Swallow=Rhipidomella clarkensis.
Orthis cleobis Hall=Rhipidomella cleobis.
Orthis clytie Hall=Heterorthis clytie.
Orthis coloradoensis Meek, 1870=Orthis? desmopleura.
Orthis coloradoensis Shumard=Billingsella coloradoensis.
Orthis concinna Hall=Dalmanella concinna.

Orthis (?) concinna Morris and Sharpe. Lower Devonian.

Orthis concinna Morris and Sharpe, Quart. Jour. Geol. Soc. London, II, 1846, p. 275, pl. 10, fig. 2.
Loc. Falkland Islands.
Obs. Probably a species of Orthothetes.

Orthis conradi Castelnau=Hipparionyx proximus.
Orthis conradi N. H. Winchell=Dalmanella subæquata conradi.
Orthis cooperensis Swallow=Rhipidomella dubia.
Orthis cora d'Orbigny=Schizophoria cora.

Orthis corinna Billings. Calciferous (Ord.).

Orthis corinna Billings, Pal. Fossils, I, 1865, p. 302, fig. 292.
Orthis? corinna Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 217.
Loc. Stanbridge, Quebec, Canada.

Orthis corpulenta Sardeson=Dalmanella testudinaria meeki.

Orthis costalis Hall. Chazy (Ord.).

Orthis costalis Hall, Pal. New York, I, 1847, p. 20, pl. 4 bis, fig. 4;—Second Ann. Rep. N. Y. State Geol., 1883, pl. 34, figs. 35-38.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 221, 228, pl. 5, figs. 15-17.
Loc. Chazy, New York.

Orthis costata Hall (non Sowerby)=Orthis pumila.
Orthis crassa James=Platystrophia crassa.
Orthis crenistria Geinitz=Derbya crassa.
Orthis crispata Emmons=Dalmanella crispata.
Orthis cumberlandia Hall=Rhipidomella cumberlandia.
Orthis cuneata Owen=Rhipidomella cuneata.

Orthis cyclas Hall=Rhipidomella cyclas.
Orthis cyclus James=Dalmanella testudinaria emacerata.
Orthis cypha James=Platystrophia laticosta.
Orthis dalyana Miller=Rhipidomella dalyana.

Orthis davidsoni de Verneuil. Anticosti and Niagara (Sil.).
Orthis davidsoni de Verneuil, Bull. Soc. Géol. de France, 2d ser., V, 1848, p. 341, pl. 4, fig. 9.—Billings, Geol. Canada, 1863, p. 312, fig. 318.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 192, 193, 221, 228, pl. 5, figs. 5–8.
Orthis alata Shaler, Bull. Mus. Comp. Zool., 4, 1865, p. 66.
Orthis calligramma var. davidsoni Nicholson and Hinde, Canadian Jour., n. ser., XIV, 1874, p. 144.—Nicholson, Pal. Prov. Ontario, 1875, p. 47, fig. 21g.
Loc. Europe; Anticosti; Dundas, Ontario.

Orthis daytonensis Foerste=Hebertella daytonensis.
Orthis deformis Hall=Orthothetes deformis.

Orthis (?) delicatula Billings. ? Calciferous (Ord.).
Orthis delicatula Billings, Pal. Fossils, I, 1865, p. 217.
Loc. Pistolet Bay and near Portland Creek, Newfoundland.

Orthis dentata Meek (non Pander)=Platystrophia crassa.

Orthis (?) desmopleura Meek. Calciferous (Ord.).
Orthis coloradoensis Meek (non Shumard), Proc. American Phil. Soc., II, 1870, p. 425.
Orthis desmopleura Meek, Hayden's U. S. Geol. Survey Wyoming, 1872, p. 295.
Loc. Colorado City and Manitou, Colorado.

Orthis dichotoma Hall=Plectorthis dichotoma.
Orthis discus Hall=Rhipidomella discus.
Orthis disparilis Conrad=Orthis tricenaria.
Orthis disparilis Owen=Dalmanella testudinaria.

Orthis disparilis Kayser. Ordovician.
Orthis disparilis Kayser (non Conrad), Palæontographica, Suppl., III, 1876, p. 26, pl. 3, figs. 4–8.
Loc. Potrero de los Angulos, etc., Argentine Republic.
Obs. Probably a new species.

Orthis dubia Hall=Rhipidomella dubia.
Orthis eboracensis Miller=Dalmanella lenticularis.
Orthis electra Billings=Dalmanella electra.
Orthis elegantula Dalman=Dalmanella elegantula.
Orthis elegantula parva Foerste=Dalmanella elegantula parva.
Orthis ella Hall=Plectorthis ella.
Orthis emacerata Hall=Dalmanella testudinaria emacerata.
Orthis emacerata Meek (non Hall)=Dalmanella testudinaria meeki.
Orthis emarginata Hall=Rhipidomella oblata emarginata.
Orthis eminens Hall=Rhipidomella eminens.
Orthis erratica Hall=Catazyga erratica.

Orthis (?) eryna Hall. Corniferous (Dev.).
Orthis æquivalvis Hall (non Hall, 1847), Tenth Rep. New York State Cab. Nat. Hist., 1857, p. 109.
Orthis eryna Hall, Sixteenth Rep. Ibidem, 1863, p. 35;—Pal. New York, IV, 1867, corrigenda.
Orthis idas Hall, Pal. New York, IV, 1867, p. 42, pl. 5, fig. 11.
Loc. Williamsville, New York.
Obs. Possibly *a species of Hipparionyx.*

Orthis (?) eudocia Billings. Calciferous (Ord.).

Orthis eudocia Billings, Pal. Fossils, I, 1862, p. 83, fig. 76.

Loc. Point Levis, Canada.

Orthis (?) eurekaensis Walcott. Upper Cambrian.

Orthis eurekensis Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 22, pl. 9, fig. 8.

Protorthis? eurekensis Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 232.

Loc. Eureka district, Nevada.

Orthis euryone Billings. Calciferous (Ord.).

Orthis euryone Billings, Pal. Fossils, I, 1862, p. 78, fig. 71.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 221, 228, pl. 5, fig. 4.

Orthis euryone? Matthew, Trans. Royal Soc. Canada, 1893, p. 101, pl. 7, fig. 5.

Loc. Point Levis, Canada; near St. John, New Brunswick.

Orthis evadne Billings=Dalmanella evadne.

Orthis fasciata Hall=Orthostrophia fasciata.

Orthis fausta Foerste=Hebertella fausta.

Orthis fissicosta Meek, and Miller=Plectorthis dichotoma.

Orthis fissicosta Hall=Plectorthis fissicosta.

Orthis (?) fissiplica Roemer. Niagara (Sil.).

Orthis fissiplica Roemer, Die silurische Fauna des west. Tennessee, 1860, p. 64, pl. 5, fig. 5.

Loc. Perry County, Tennessee.

Orthis flabella Hall=Orthis flabellites.

Orthis flabellites Foerste. Clinton and Niagara (Sil.).

Orthis flabellulum? Hall (non Sowerby), Geol. N. Y.; Rep. Fourth Dist., 1843, p. 105, fig. 5.

Orthis flabellulum var. Hall, Pal. New York, II, 1852, pp. 254, 255, pl. 52, figs. 6, 7.

Orthis flabellulum Billings, Canadian Nat. Geol., I, 1856, p. 136, pl. 2, fig. 6.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 38, pl. 34, fig. 30.

Orthis flabella Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 34, figs. 41, 42; pl. 35, figs. 6–8.—Foerste, Bull. Denison Univ., I, 1885, p. 82, pl. 13, fig. 12.

Orthis calligramma Foerste (non Dalman), Proc. Boston Soc. Nat. Hist., XXIV, 1890, p. 308, pl. 6, figs. 4, 5.

Orthis flabellites Foerste, Ibidem, 1890, p. 311.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 221, 227, pl. 5, figs. 37–41; pl. 20, fig. 1.

Orthis (Dinorthis) calligramma Foerste, Geol. Ohio, VII, 1895, p. 570, pl. 25, figs. 12a, 12b; pl. 31, figs. 4, 5; pl. 37A, fig. 20.

Loc. Lockport, Rochester, etc., New York; Dayton, Ohio; Osgood, Indiana; Louisville, Kentucky; Milwaukee, Wisconsin; Dundas, Ontario.

Orthis flabellites spania Hall and Clarke. Niagara (Sil.).

Orthis flabellites var. spania Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 84, figs. 10.

Loc. Near Milwaukee, Wisconsin.

Orthis flabellulum Hall (non Sowerby)=Orthis flabellites.

Orthis (?) flava A. Winchell. Kinderhook (L. Carb.).

Orthis flava A. Winchell, Proc. Acad. Nat. Sci. Philadelphia, 1865, p. 117.

Loc. Burlington, Iowa.

Orthis futilis Sardeson=Dalmanella testudinaria futilis.

Orthis gemmicula Billings=Orthidium gemmicula.

Orthis gibbosa Billings=Dalmanella subæquata gibbosa.

Orthis goodwini Nettelroth=Rhipidomella goodwini.

Orthis (?) glypta Hall and Clarke. Niagara (Sil.).

Orthis ? glypta Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, p. 359, pl. 84, figs. 8, 9.

Loc. Near Milwaukee, Wisconsin.

Orthis halli Safford=Orthostrophia strophomenoides.

Orthis hamburgensis Walcott=Dalmanella hamburgensis.

Orthis harttii Rathbun=Rhipidomella hartti.

Orthis (?) highlandensis Walcott. Lower Cambrian.

Orthis(?) highlandensis Walcott, Bull. U. S. Geol. Survey, 30, 1886, p. 119, pl. 8, fig. 3.

Orthis highlandensis Walcott, Tenth Ann. Rep. U. S. Geol. Survey, 1891, p. 612, pl. 72, fig. 5.

Loc. Pioche and Highland Range, Nevada.

Orthis hipparionyx Hall=Hipparionyx proximus.

Orthis hippolyte Billings. Calciferous (Ord.).

Orthis hippolyte Billings, Pal. Fossils, I, 1862, p. 81, fig. 73; p. 218.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 217, 221, 228.

Orthis hippolyte? Meek, Sixth Ann. Rep. U. S. Geol. Survey Terr., 1873, p. 464.

Loc. Point Levis and Phillipsburg, Canada; Cow Head, Newfoundland; near Malade City, Utah.

Orthis (?) holstoni Safford. Trenton (Ord.).

Orthis? holstoni (Safford MS.) Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 218, 340, pl. 5A, figs. 35–37.

Loc. Near Nashville, Tennessee.

Orthis humboldti d'Orbigny. Silurian.

Orthis humboldtii d'Orbigny, Voyage dans l'Amérique Méridionale, Pal., 1842, p. 27.

Spirifer humboldtii d'Orbigny, Ibidem, pl. 2, figs. 16–20.

Loc. Bolivia.

Orthis huroniensis Castlenau=Rafinesquina alternata.

Orthis hybrida Sowerby=Rhipidomella hybrida.

Orthis idas Hall=Orthis eryna.

Orthis idonea Hall=Rhipidomella idonea.

Orthis ignota Sardeson=Dalmanella testudinaria ignota.

Orthis imperator Billings=Hebertella imperator.

Orthis impressa Hall=Schizophoria striatula.

Orthis inequalis Hall=Orthothetes inæqualis.

Orthis inca d'Orbigny=Rhipidomella inca.

Orthis infera Calvin=Dalmanella infera.

Orthis insculpta Hall=Hebertella insculpta.

Orthis insignis Hall=Scenidium insignis.

Orthis interlineata Hall (non Sowerby)=Schizophoria tioga.

Orthis interstriata Hall=Orthothetes interstriatus.

Orthis iowensis Hall=Schizophoria striatula.

Orthis iowensis furnarius Hall=Schizophoria striatula.

Orthis iphigenia Billings=Dinorthis iphigenia.

Orthis jamesi Hall=Plectorthis jamesi.

Orthis jugosa James=Dalmanella testudinaria meeki.

Orthis kankakensis McChesney=Plectorthis kankakiensis.

Orthis kaskaskiensis McChesney=Derbya kaskaskiaensis.
Orthis kassubæ Winchell=Dalmanella subæquata pervetus.
Orthis kennicotti McChesney=Dinorthis retrorsa.
Orthis keokuk Hall=Derbya keokuk.
Orthis lasallensis McChesney=Derbya crassa.
Orthis laticosta Meek=Platystrophia laticosta.

Orthis (?) laticostata d'Orbigny. Devonian.

Orthis lacticostata d'Orbigny, Voyage dans l'Amérique Méridionale, Pal., 1842, p. 39.

Loc. ? Bolivia.

Orthis laurentina Billings=Billingsella? laurentina.

Orthis lenticularis Wahlenberg?. Upper Cambrian.

Orthis lenticularis (Wahl.) Kayser, Palæontographica, Suppl., III, 1876, p. 9, pl. 1, figs. 11, 12.—Matthew, Trans. Royal Soc. Canada, IX, 1892, p. 46, pl. 12, figs. 9a–9d.

Loc. Province Salta and Jujuy, Argentine Republic; near St. John, New Brunswick.

Orthis lenticularis atrypoides Matthew. Upper Cambrian.

Orthis lenticularis var. atrypoides Matthew, Trans. Royal Soc. Canada, IX, 1892, p. 48, pl. 12, figs. 11a, 11b.

Loc. Near St. John, New Brunswick.

Orthis lenticularis lyncioides Matthew. Upper Cambrian.

Orthis lenticularis var. lyncioides Matthew, Trans. Royal Soc. Canada, IX, 1892, p. 49, pl. 12, figs. 10a–10c.

Loc. Near St. John, New Brunswick.

Orthis lenticularis strophomenoides Matthew. Upper Cambrian.

Orthis lenticularis var. strophomenoides Matthew, Trans. Royal Soc. Canada, IX, 1892, p. 49, pl. 12, figs. 12a, 12b.

Loc. Near St. John, New Brunswick.

Orthis lenticularis Vanuxem=Dalmanella lenticularis.
Orthis lentiformis Hall=Dalmanella lenticularis.
Orthis lentiformis Owen=Schizophoria striatula.
Orthis leonensis Hall=Dalmanella tenuilineata.
Orthis lepida Hall=Dalmanella lepida.

Orthis (?) leptænoides Emmons. Trenton (Ord.).

Orthis leptænoides Emmons, Geol. N. Y.; Rep. Fourth Dist., 1842, p. 396, fig. 1.

Loc. New York.

Obs. Undefined and figure too poor for identification.

Orthis leucosia Hall=Rhipidomella leucosia.
Orthis limitaris Vanuxem=Leiorhynchus limitare.
Orthis linneyi James=Orthorhynchula linneyi.
Orthis livia Billings=Rhipidomella livia.
Orthis lonensis Walcott=Hebertella lonensis.
Orthis loricula Hall=Dinorthis deflecta.
Orthis lucia Billings=Rhipidomella lucia.
Orthis lynx Eichwald=Platystrophia lynx and P. biforata.
Orthis maria Billings=Hebertella maria.
Orthis macfarlanii Meek=Schizophoria macfarlanii.

Orthis macleodi Whitfield=Dalmanella macleodi.
Orthis macrior Sardeson=Dalmanella testudinaria emacerata.
Orthis media Shaler=Rhipidomella media.
Orthis media N. H. Winchell=Dalmanella subæquata pervetus.
Orthis meeki Miller=Dalmanella testudinaria meeki.
Orthis menapiæ Hicks. Calciferous (Ord.).
Orthis menapiæ (Hicks MS.) Davidson, Geol. Mag. London, V, 1868, p. 314, pl. 16, figs. 24–28.—Matthew, Trans. Royal Soc. Canada, X, 1893, p. 101, pl. 7, figs. 2–6.
Loc. England; near St. Johns, New Brunswick.
Orthis merope Billings=Scenidium merope.
Orthis michelini L'Éveillé=Rhipidomella michelini.
Orthis michelini Meek, 1877=Rhipidomella nevadaensis.
Orthis michelini burlingtonensis Hall=Rhipidomella burlingtonensis.
Orthis (?) minna Billings. Calciferous (Ord.).
Orthis minna Billings, Pal. Fossils, I, 1865, p. 303, fig. 294.
Loc. Stanbridge, Quebec, Canada.
Orthis minneapolis N. H. Winchell=Dalmanella subæquata.
Orthis minnesotensis Sardeson=Dinorthis meedsi.
Orthis missouriensis Shumard. Cape Girardeau Limestone (Sil.).
Orthis missouriensis Shumard, Geol. Rep. Missouri, 1855, p. 205, pl. C, fig. 9.—Keyes, Geol. Survey Missouri, V, 1895, p. 60.
Loc. Two miles above Cape Girardeau, Missouri.
Orthis missouriensis Swallow (non Shumard)=Rhipidomella missouriensis.
Orthis mitis Hall=Rhipidomella mitis.
Orthis morganiana Derby=Orthotichia morganiana.
Orthis (?) morrowensis James. Lorraine (Ord.).
Orthis (?) morrowensis James, Cincinnati Quart. Jour. Sci., I, 1874, p. 21.
Loc. Warren County, Ohio.
Orthis multisecta (James) Meek=Dalmanella multisecta.
Orthis multistriata Hall=Schizophoria multistriata.
Orthis musculosa Hall=Rhipidomella musculosa.
Orthis (?) mycale Billings. Calciferous (Ord.).
Orthis mycale Billings, Pal. Fossils, I, 1862, p. 82, fig. 75.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 217, pl. 7A, figs. 10, 11.
Loc. Point Levis, Canada.
Orthis neglecta James=Plectorthis dichotoma.
Orthis nettoana Rathbun=Dalmanella nettoana.
Orthis nevadensis Meek=Rhipidomella nevadaensis.
Orthis (?) nisis Hall and Whitfield. Niagara (Sil.).
Orthis nisis Hall and Whitfield, Twenty-fourth Rep. N. Y. State Cab. Nat. Hist., 1872, p. 181;—Twenty-seventh Rep. Ibidem, 1875, pl. 9, figs. 4–8.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 42, pl. 27, figs. 4, 5.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 217.
Loc. Louisville, Kentucky.
Orthis nucleus Hall=Ambocœlia umbonata.
Orthis oblata Hall=Rhipidomella oblata.

Orthis oblata emarginata Hall=Rhipidomella oblata emarginata.

Orthis obtusa Pander. Ordovician.

Orthis obtusa (Pander) Kayser, Palæontographica, Suppl., III, 1876, p. 19, pl. 3, figs. 1, 2.

Loc. Europe; Cordillere San Juan, Argentine Republic.

Orthis occasus Hall=Rhipidomella occasus.

Orthis occidentalis Hall=Hebertella occidentalis.

Orthis orthambonites Billings=O. panderiana.

Orthis palmata Sharpe and Salter=Anoplotheca flabellites.

Orthis panderiana Hall and Clarke. Calciferous (Ord.).

Orthis orthambonites Billings (non Murchison and de Verneuil), Pal. Fossils, I, 1862, p. 77, fig. 70;—Geol. Canada, 1863, p. 231, fig. 245.—Schuchert, Ninth Ann. Rep. N. Y. State Geol., 1890, p. 43.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 221, 228, pl. 5, figs. 1–3.—Matthew, Trans. Royal Soc. Canada, X, 1893, p. 101, pl. 7, fig. 4.

Orthis panderiana Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 5, footnote.

Loc. Point Levis and St. John, Canada.

Orthis parva de Verneuil=Dalmanella elegantula.

Orthis pecosi Marcou=Rhipidomella pecosi.

Orthis (?) pectinata d'Orbigny. Devonian.

Orthis pectinatus d'Orbigny, Voyage dans l'Amérique Méridionale, Pal., 1842, p. 39.

Spirifer pectinatus d'Orbigny, Ibidem, 1842, pl. 2, figs. 13–15.

Loc. Lake Titicaca, Bolivia.

Obs. Probably a species of Orthothetes.

Orthis pectinella Emmons=Dinorthis pectinella.

Orthis pectinella Whitfield, 1882=Plectorthis whitfieldi.

Orthis pectinella semiovalis Hall=Dinorthis pectinella.

Orthis peduncularis Hall=Schizophoria peduncularis.

Orthis peloris Hall=Rhipidomella peloris.

Orthis penelope Hall=Rhipidomella penelope.

Orthis penniana Derby=Rhipidomella penniana.

Orthis pennsylvanica Simpson=Rhipidomella pennsylvanica.

Orthis pepina Hall=Billingsella coloradoensis.

Orthis perelegans Hall=Dalmanella perelegans.

Orthis perversa Hall=Orthothetes chemungensis perversus.

Orthis perveta Conrad=Dalmanella subæquata pervetus.

Orthis perveta Hall, 1883=Dalmanella subæquata.

Orthis petræ Sardeson=Dinorthis proavita.

Orthis (?) pigra Billings. Chazy (Ord.).

Orthis piger Billings, Canadian Nat. Geol., IV, 1859, p. 442.

Loc. Mingan Island.

Obs. This species is probably congeneric with Billingsella grandæva.

Orthis pisum Hall (non Murchison)=Nucleospira pisiformis.

Orthis plana Castelnau (non Pander)=Rafinesquina alternata.

Orthis planoconvexa Hall=Dalmanella planiconvexa.

Orthis platys Billings=Dinorthis platys.

Orthis plicata Vanuxem=Spirifer vanuxemi.

Orthis plicatella White (non Hall)=Orthis tricenaria.
Orthis plicatella Hall=Plectorthis plicatella.
Orthis pogonipensis Hall and Whitfield=Dalmanella pogonipensis.
Orthis porcata McCoy=Dinorthis porcata.

Orthis (?) porcia Billings. Chazy (Ord.).

Orthis porcia Billings, Canadian Nat. Geol., IV, 1859, p. 439, figs. 16–18;—Geol. Canada, 1863, p. 130, fig. 58.
Loc. Near Montreal, Canada.

Orthis porrecta Sardeson=Dalmanella testudinaria porrecta.
Orthis præumbona Hall=Ambocœlia præumbona.
Orthis pratteni McChesney=Derbya pratteni.
Orthis pravus Hall=Orthothetes pravus.
Orthis propinqua Hall=Schizophoria propinqua.
Orthis propinqua Nettelroth=Schizophoria striatula.

Orthis (?) pumila Ulrich. Lorraine (Ord.).

Orthis costata (non Sowerby) Hall, American Jour. Sci., XLVIII, 1845, p. 295.—Miller, Cincinnati Quart. Jour. Sci., II, 1875, p. 33.
Orthis pumila Ulrich, Catalogue Cincinnati Fossils, 1880, p. 14.
Orthis cincinnatiensis Miller, American Pal. Fossils, 2d ed., 1883, p. 296.
Loc. Cincinnati, Ohio.

Orthis (?) punctostriata Hall. Niagara (Sil.).

Orthis punctostriata Hall, Pal. New York, II, 1852, p. 254, pl. 52, fig. 5.
Orthis? punctostriata Hall and Clarke, Ibidem, VIII, Pt. I, 1892, p. 217, pl. 20, figs. 2–4.
Loc. Lockport, New York.

Orthis pyramidalis Hall=Scenidium pyramidalis.
Orthis quacoensis Matthew=Billingsella quacoensis.
Orthis quadrans Hall=Dalmanella quadrans.
Orthis quadricostata Vanuxem=Leiorhynchus quadricostatum.

Orthis(?) remnicha N. H. Winchell. Upper Cambrian.

Orthis remnicha N. H. Winchell, Fourteenth Ann. Rep. Geol. Nat. Hist. Survey of Minnesota, 1886, p. 317, pl. 2, fig. 7.
Loc. Red Wing, Minnesota; Cold Creek Canyon, Burnett County, Texas.

Orthis resupinata Hall, 1843 (non Martin)=Schizophoria tulliensis.
Orthis resupinata Martin=Schizophoria resupinata.
Orthis resupinata latirostrata Toula=Schizophoria cora.
Orthis resupinoides Cox=Schizophoria resupinoides.
Orthis retrorsa Salter=Dinorthis retrorsa.
Orthis rhynchonelliformis Shaler=Rhipidomella rhynchonelliformis.
Orthis richmonda McChesney=Derbya crassa.
Orthis robusta Hall=Derbya robusta.
Orthis rogata Sardeson=Dalmanella testudinaria.

Orthis (?) rugiplicata Hall and Whitfield. Niagara (Sil.).

Orthis rugæplicata Hall and Whitfield, Twenty-fourth Rep. N. Y. State Cab. Nat. Hist., 1872, p. 182;—Twenty-seventh Rep. Ibidem, 1875, pl. 9, figs. 1–3.—Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 34, figs. 25–27.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 44, pl. 27, figs. 1–3.
Orthis rugiplicata, Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 217.
Loc. Louisville, Kentucky.

Orthis (?) ruida Billings. Anticosti (Sil.).

Orthis ruida Billings, Catalogue Silurian Fossils of Anticosti, 1866, p. 42.
Loc. Anticosti.

Orthis (?) saffordi Hall and Clarke. Trenton (Ord.).

Orthis ? saffordi, Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 218, 340, pl. 5A, figs. 38–40.
Loc. "East Tennessee."

Orthis (?) salemensis Walcott. Lower Cambrian.

Orthis salemensis Walcott, American Jour. Sci., 3d ser., XXXIV, 1887, p. 190, pl. 1, fig. 17;—Tenth Ann. Rep. U. S. Geol. Survey, 1891, p. 612, pl. 72, fig. 6.
Loc. Washington County, New York; near Quebec, Canada.

Orthis saltensis Kayser. Upper Cambrian.

Orthis saltensis Kayser, Palæontographica, Suppl., III, 1876, p. 8, pl. 1, fig. 16.
Loc. Province Salta and Jujuy, Argentine Republic.

Orthis (?) sandbergeri N. H. Winchell. Upper Cambrian.

Orthis sandbergeri N. H. Winchell, Fourteenth Ann. Rep. Geol. Nat. Hist., Survey of Minnesota, 1886, p. 318, pl. 2, figs. 8, 9.
Loc. Red Wing, Minnesota.

Orthis schohariensis Castelnau=Strophonella schohariensis.
Orthis scovilli Miller=Hebertella scovilli.
Orthis sectostriata Ulrich=Plectorthis sectistriata.
Orthis semele Hall=Rhipidomella semele.
Orthis sinuata Hall=Hebertella sinuata.

Orthis (?) sola Billings. Lorraine (Ord.).

Orthis sola Billings, Catalogue Silurian Fossils of Anticosti, 1866, p. 12.
Loc. Anticosti.

Orthis solitaria Hall=Rhipidomella solitaria.
Orthis stonensis Safford=Dalmanella stonensis.
Orthis striatocostata Geinitz=Meekella striaticostata.
Orthis striatula Emmons (non Schlotheim)=Dalmanella testudinaria.
Orthis striatula of authors=Schizophoria striatula.
Orthis strophomenoides Hall=Orthostrophia strophomenoides.
Orthis subæquata Conrad=Dalmanella subæquata.
Orthis subcarinata Hall=Dalmanella subcarinata.
Orthis subcircula Simpson=Rhipidomella subcirculus.
Orthis subelliptica White and Whitfield=Rhipidomella subelliptica.
Orthis subjugata Hall=Hebertella occidentalis.

Orthis (?) subnodosa Hall. Niagara (Sil.).

Orthis subnodosa Hall, Descriptions of n. sp. Fossils from Waldron, Indiana, 1879, p. 14;—Eleventh Rep. State Geol. Indiana, 1882, p. 286, pl. 27, fig. 17;—Trans. Albany Institute, X, 1883, p. 70.—Nettelroth, Kentucky Fossil Shells, Mem., Kentucky Geol. Survey, 1889, p. 44.
Loc. Waldron, Indiana; Louisville, Kentucky.

Orthis suborbicularis Hall=Rhipidomella suborbicularis.
Orthis subquadrata Hall=Dinorthis subquadrata.
Orthis subumbona Hall=Martinia subumbona.

Orthis (?) sulivanti Morris and Sharpe. Lower Devonian.

Orthis sulivanti Morris and Sharpe, Quart. Jour. Geol. Soc. London, II, 1846, p. 275, pl. 10, fig. 1.

Loc. Falkland Islands; South Africa.

Orthis swallovi Hall=Schizophoria swallovi.

Orthis sweeneyi Winchell=Dinorthis pectinella sweeneyi.

Orthis (?) tenuidens Hall. Clinton (Sil.).

Orthis tenuidens Hall, Pal. New York, II, 1852, p. 58, pl. 20, fig. 9.

Loc. Oneida County, New York.

Obs. May be a species of Orthothetes.

Orthis (?) tenuis Morris and Sharpe. Lower Devonian.

Orthis tenuis Morris and Sharpe, Quart. Jour. Geol. Soc. London, II, 1846, p. 275, pl. 10, fig. 4; pl. 11, fig. 4.

Loc. Falkland Islands.

Obs. Similar to Chonostrophia complanata Hall.

Orthis (?) tenuistriata Hall. Portage (Dev.).

Orthis tenuistriata Hall, Geol. N. Y.; Rep. Fourth Dist., 1843, p. 245, fig. 3.

Loc. Shores of Crooked Lake, New York.

Obs. This is not an Orthis; probably a pelecypod.

Orthis tersus Sardeson=Dalmanella tersa.

Orthis testudinaria Dalman=Dalmanella testudinaria.

Orthis testudinaria Owen, 1844=O. tricenaria.

Orthis thiemii White=Rhipidomella thiemei.

Orthis tioga Hall=Schizophoria tioga.

Orthis tricenaria Conrad. Trenton (Ord.).

Orthis tricenaria Conrad, Proc. Acad. Nat. Sci. Philadelphia, I, 1843, p. 333.—Hall, Pal. New York, I, 1847, p. 121, pl. 32, fig. 8.—Salter, Canadian Organic Remains, Decade I, 1859, p. 39, pl. 9, figs. 1–4.—Hall, Geol. Wisconsin, I, 1862, p. 42, figs. 8–11.—Billings, Geol. Canada, 1863, p. 167, fig. 151.—Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 35, figs. 1–5.—†Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 74, pl. 11, fig. 4.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 191, 193, 221, 228, pl. 5, figs. 9–14.—Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 418, pl. 32, figs. 18–23.—Keyes, Geol. Survey Missouri, V, 1895, p. 60, pl. 39, fig. 4.—Whiteaves, Pal. Foss., III, Pt. III, 1897, p. 175.

Orthis disparilis Conrad, Proc. Acad. Nat. Sci. Philadelphia, I, 1843, p. 333.—Hall, Pal. New York, I, 1847, p. 119, pl. 32, fig. 4.—Billings, Canadian Nat. Geol., IV, 1859, p. 440, fig. 20.—Hall, Geol. Wisconsin, I, 1862, p. 435.—Billings, Geol. Canada, 1863, p. 130, fig. 60.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 191, 221, 228.

Orthis testudinaria? Owen, Geol. Expl. Iowa, Wisconsin, and Illinois, 1844, pl. 15, fig. 11.

†Orthis plicatella White (non Hall), Wheeler's Expl. and Survey west 100th Merid., IV, 1875, p. 72, pl. 4, fig. 10.

Loc. Mineral Point, Wisconsin; Middleville, etc., New York; Kentucky; Tennessee; near Ottawa and Montreal, Canada; Mingan Islands; Lake Winnipeg, Manitoba; White Pine and Eureka districts, Nevada; Minneapolis, etc., Minnesota; Pike County, Missouri.

Obs. O. plicatella White and O. tricenaria Walcott may prove to be distinct from O. tricenaria Conrad.

Orthis (?) trinucleus Hall. Clinton (Sil.).

Orthis trinucleus Hall, Pal. New York, II, 1852, p. 58, pl. 20, fig. 8.

Loc. Wayne County, New York.

Orthis triplicatella Meek=Plectorthis triplicatella.

Orthis (?) tritonia Billings. Calciferous (Ord.).

Orthis tritonia Billings, Pal. Fossils, I, 1862, p. 76, fig. 69;—Geol. Canada, 1863, p. 231, fig. 244.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 217, pl. 7A, figs. 12, 13.

Loc. Point Levis, Canada.

Orthis tubulostriata Hall=Rhipidomella tubulistriata.

Orthis tulliensis Vanuxem=Schizophoria tulliensis.

Orthis uberis Billings=Rhipidomella uberis.

Orthis umbonata Conrad=Ambocœlia umbonata.

Orthis umbraculum Owen (non von Buch)=Derbya robusta.

Orthis umbraculum Hall, 1852, Newberry, 1861=Orthothetes umbraculum.

Orthis unguiculus Hall, 1843 (non Phillips)=Ambocœlia gregaria.

Orthis unguiformis Castelnau, and Emmons=Hipparionyx proximus.

Orthis vanuxemi Hall=Rhipidomella vanuxemi.

Orthis vanuxemi pulchella Herrick=Rhipidomella vanuxemi pulchella.

Orthis varica Conrad=Bilobites varicus.

Orthis vespertilio Sowerby. Ordovician.

Orthis vespertilio (Sowerby) Kayser, Palæontographica, Suppl., III, 1876, p. 27, pl. 3, figs. 22, 23.

Loc. Europe; Potrero de los Angulos, etc., Argentine Republic.

Orthis whitfieldi N. H. Winchell=Plectorthis whitfieldi.

Orthisina d'Orbigny=Clitambonites.

Orthisina alberta Walcott=Billingsella alberta.

Orthisina alternata Hall=Orthothetes chemungensis perversus.

Orthisina americana Whitfield=Clitambonites diversus.

Orthisina arctostriata Hall=Orthothetes chemungensis arctistriatus.

Orthisina crassa Meek and Hayden=Derbya crassa.

Orthisina diversa Shaler=Clitambonites diversus.

Orthisina festinata Billings=Billingsella festinata.

Orthisina grandæva Billings=Billingsella grandæva.

Orthisina missouriensis Swallow=Meekella striaticostata.

Orthisina transversa Walcott=Billingsella transversa.

Orthisina verneuili Billings=Clitambonites diversus.

ORTHORHYNCHULA Hall and C. Genotype Orthis (?) linneyi James.

Orthorhynchula Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 181;—Thirteenth Ann. Rep. N. Y. State Geologist, 1895, p. 824.

Orthorhynchula linneyi (James). Lorraine (Ord.).

Orthis (?) linneyi James, The Paleontologist, 5, 1881, p. 41.

Orthis linneyi Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 41, pl. 34, figs. 7–18; errata, p. 1.

Orthorhynchula linneyi Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 181, pl. 56, figs. 10–13, 19.

Loc. Near Danville, etc., Kentucky; Cincinnati, Ohio; Nashville, Tennessee.

ORTHOSTROPHIA Hall. Genotype Orthis strophomenoides Hall.

Orthostrophia Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 36, figs. 32–34.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 199, 223, 253;—Eleventh Ann. Rep. N. Y. State Geologist, 1894, p. 267.

Orthostrophia (?) fasciata Hall. Niagara (Sil.).

Orthis fasciata Hall, Pal. New York, II, 1852, p. 255, pl. 52, fig. 8.

Orthostrophia ? fasciata Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 200, 223.

Loc. Rochester and Lockport, New York.

Orthostrophia strophomenoides Hall. Lower Helderberg (Dev.).

Orthis strophomenoides Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 46;—Pal. New York, III, 1859, p. 177, pl. 14, fig. 2.

Orthis halli Safford, Geol. Tennessee, 1869, pp. 328, 533.

Orthostrophia strophomenoides Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 36, figs. 32–34.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 200, 223, pl. 5A, figs. 24–27; pl. 6, figs. 32–34.

Orthostrophia halli Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 5A, figs. 22, 23.

Loc. Albany and Schoharie counties, New York; Square Lake, Maine; Perry County, Tennessee.

ORTHOTHETES Fischer de Wald. Genotype Spirifera crenistria Phil.

Orthothetes Fischer de Waldheim, Oryctographie du Gouvernement de Moscou, 1837, p. 133.—Waagen, Palæontologica Indica, Ser. XIII, I, p. 607, 1884.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 253;—Eleventh Ann. Rep. N. Y. State Geologist, 1894, p. 284.

Streptorhynchus Hall (non King), Sixteenth Rep. N. Y. State Cab. Nat. Hist., 1863, p. 61, figs. 1–6;—Pal. New York, IV, 1867, p. 64.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 139.

Orthothetes agassizi (Rathbun). Middle Devonian.

Streptorhynchus agassizi (Hartt) Rathbun, Bull. Buffalo Soc. Nat. Sci., I, 1874, p. 248, pl. 9, figs. 3, 4, 10, 16, 17, 23, 25, 26, 28–30;—Proc. Boston Soc. Nat. Hist., XX, 1879, p. 24.

Loc. Erere, Province of Para, Brazil.

Orthothetes anomalus (A. Winchell). Hamilton (Dev.).

Crania (Pseudocrania) anomala A. Winchell, Geol. Rep. Lower Peninsula Michigan, 1866, p. 92.

Streptorhynchus anomala Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 152.

Loc. Grand Traverse region, Michigan.

Orthothetes bellulus Clarke. Marcellus (Dev.).

Orthothetes bellulus Clarke, Thirteenth Ann. Rep. N. Y. State Geologist, 1895, pp. 176, 187, pl. 4, figs. 2–4.

Loc. Livonia salt shaft, Livonia, New York.

Orthothetes chemungensis (Conrad). Chemung (Dev.).

Strophomena chemungensis Conrad, Jour. Acad. Nat. Sci. Philadelphia, VIII, 1842, p. 257, pl. 14, fig. 12.

Strophomena bifurcata Hall, Geol. N. Y.; Rep. Fourth Dist., 1843, p. 266, fig. 2.

Strophomena pectinacea Hall, Ibidem, 1843, p. 266, fig. 4.

Streptorhynchus chemungensis Hall, Pal. New York, IV, 1867, p. 67;—Second Ann. Rep. N. Y. State Geol., 1883, pl. 40, fig. 9.—Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 117, pl. 13, fig. 16.

Streptorhynchus chemungensis var. pectinacea Hall, Pal. New York, IV, 1867, p. 73, pl. 10, fig. 6.

Orthothetes chemungensis (Conrad)—Continued.

Orthothetes chemungensis Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 255, pl. 10, fig. 9; pl. 11A, fig. 14.—Whiteaves, Cont. Canadian Pal., I, 1892, p. 285.

Loc. New York and Pennsylvania; Eureka district, Nevada; Lake Winnipegosis, Canada; Waverly group of Ohio.

Orthothetes chemungensis arctistriatus Hall. Hamilton (Dev.).

Strophomena arctostriata Hall, Geol. N. Y.; Rep. Fourth Dist., 1843, p. 266, fig. 3.

Orthisina arctostriata Hall, Thirteenth Rep. N. Y. State Cab. Nat. Hist., 1860, pp. 80, 81, figs. 1, 2; p. 112.

Streptorhynchus chemungensis var. arctostriata Hall, Pal. New York, IV, 1867, p. 71, pl. 9, figs. 1-12;—Second Ann. Rep. N. Y. State Geol., 1883, pl. 40, fig. 8.

Hemipronites chemungensis var. arctostriata Meek, King's U. S. Geol. Expl. 40th Parl., IV, 1877, p. 35, pl. 3, fig. 2.

Streptorhynchus arctostriata Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 117, pl. 13, fig. 7.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 140, pl. 31, figs. 31-33.

Orthothetes chemungensis var. arctostriata Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 10, fig. 8.

Loc. New York; Falls of Ohio; Eureka district, Nevada.

Orthothetes chemungensis perversus (Hall). Cornif. and Ham. (Dev.).

Orthis perversa Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 137.

Orthisina alternata Hall, Thirteenth Rep. N. Y. State Cab. Nat. Hist., 1860, p. 81, figs. 1, 2; p. 112.

Streptorhynchus chemungensis var. perversus Hall, Pal. New York, IV, 1867, p. 72, pl. 9, figs. 13-17, 26.

Streptorhynchus chemungensis var. alternata Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 40, fig. 7.

Orthothetes chemungensis var. alternata Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 10, fig. 7.

Loc. New York; Bosanquet, Ontario; Eureka district, Nevada.

Orthothetes crenistria (Phillips?). Lower Carboniferous.

Streptorhynchus crenistria? A. Winchell, Proc. Acad. Nat. Sci. Philadelphia, 1862, p. 410.

Streptorhynchus crenistria Davidson, Quart. Jour. Geol. Soc. London, XIX, 1863, p. 173, pl. 9, fig. 19.—Dawson, Acadian Geology, 3d ed., 1878, p. 296, fig. 96.—Etheridge, Quart. Jour. Geol. Soc. London, XXXIV, 1878, p. 362.

Hemipronites crenistria? Meek, Pal. Ohio, II, 1875, p. 279, pl. 10, fig. 5.

Hemipronites crenistria Meek, King's U. S. Geol. Expl. 40th Parl., IV, 1877, p. pl. 7, fig. 2.—Herrick, Bull. Denison Univ., III, 1888, p. 37, pl. 5, fig. 14; pl. 3, fig. 24; pl. 6, fig. 8; pl. 9, fig. 21; IV, p. 24, pl. 2, figs. 1, 5;—Geol. Ohio, VII, 1895, pl. 15, fig. 1; pl. 21, fig. 14.

Orthothetes crenistria Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 255, pl. 11A, fig. 15.

Loc. Medina and Granville, Ohio; Port aux Barques, Michigan; East River and Shubenacadie, Nova Scotia; Feilden Isthmus, lat. 82° 43′; White Pine district, Nevada.

Obs. These references are unsatisfactory identifications of Phillips's species. It may prove that more than a single species is here included.

Orthothetes deformis Hall. Lower Helderberg (Dev.).

Orthis deformis Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 44;—Pal. New York, III, 1859, p. 174, pl. 10A, fig. 13; pl. 15, fig. 3.

Orthothetes deformis Hall—Continued.

Streptorhynchus deformis Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 39, fig. 32.

Orthothetes deformis Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 255, pl. 9, fig. 32.

Loc. Albany County, New York; Cumberland, Maryland.

Orthothetes deformis sinuatus Hall and Clarke. Lower Helderberg (Dev.).

Orthothetes deformis var. sinuata Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 20, figs. 8, 9.

Loc. Cumberland, Maryland.

Orthothetes desideratus Hall and Clarke. Waverly (L. Carb.).

Orthothetes desideratus Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 345, pl. 9A, figs. 26, 27.

Loc. Medina County, Ohio.

Orthothetes flabellum (Whitfield). Corniferous (Dev.)

Streptorhynchus flabellum Whitfield, Annals N. Y. Acad. Sci., II, 1882, p. 200;—Ibidem, V, 1891, p. 521, pl. 6, figs. 7, 9;—Geol. Ohio, VII, 1895, p. 421, pl. 2, figs. 7, 9.

Loc. Columbus, Ohio.

Orthothetes hydraulicus (Whitfield). Waterlime (Sil.).

Streptorhynchus hydraulicum Whitfield, Annals N. Y. Acad. Sci., II, 1882, p. 193;—Ibidem, V, 1891, p. 508, pl. 5, figs. 1–3;—Geol. Ohio, VII, 1895, p. 410, pl. 1, figs. 1–3.

Loc. Bellville and Greenfield, Ohio.

Orthothetes inæqualis Hall. Kinderhook (L. Carb.).

Orthis inequalis Hall, Geol. Survey Iowa, I, Pt. II, 1858, p. 490, pl. 2, fig. 6.

Streptorhynchus inequalis A. Winchell, Proc. Acad. Nat. Sci. Philadelphia, 1865, p. 117.

Streptorhynchus equivalvis Hall and Whitfield, King's U. S. Geol. Expl. 40th Parl., IV, 1877, p. 252, pl. 4, figs. 1, 2.

Streptorhynchus æquivalvis Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 42, figs. 20–23.

Orthothetes inæqualis Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 9A, figs. 20–23.

Loc. Burlington, Iowa; Newark and Granville, Ohio; Shafers, Pennsylvania; Wasatch Range, Utah.

Orthothetes inflatus (White and Whitfield). Kinderhook (L. Carb.).

Streptorhynchus inflatus White and Whitfield, Proc. Boston Soc. Nat. Hist., VIII, 1862, p. 293.—Hall and Whitfield, King's U. S. Geol. Expl. 40 Parl., IV, 1877, p. 252, pl. 4, fig. 3.—Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 42, figs. 24, 25.

Orthothetes inflatus Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 9A, figs. 24, 25.

Loc. Burlington, Iowa; Dry Canyon, Oquirrh Mountains, Utah; Montana.

Orthothetes interstriatus (Hall). Coralline (Sil.).

Orthis interstriata Hall, Pal. New York, II, 1852, p. 326, pl. 74, figs. 1, 2.

Loc. Schoharie, New York.

Orthothetes lens (White). Kinderhook (L. Carb.).

Streptorhynchus lens White, Proc. Boston Soc. Nat. Hist., IX, 1862, p. 28.—Keyes, Geol. Survey Missouri, V, 1895, p. 67, pl. 39, fig. 2.

Streptorhynchus lens? A. Winchell, Proc. Acad. Nat. Sci. Philadelphia, 1865, p. 117.

Orthothetes lens (White)—Continued.

Orthothetes lens Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 256, pl. 11A, figs. 16–22.

Loc. Clarksville, etc., Missouri; Hamburg, Illinois; Medina County, Ohio (Winchell).

Orthothetes pandora (Billings). Upper Helderberg (Dev.).

Streptorhynchus pandora Billings, Canadian Jour., V, 1860, p. 226, figs. 12, 13;—Geol. Canada, 1863, p. 369, fig. 384.—Nicholson, Pal. Prov. Ontario, 1874, p. 70.

Streptorhynchus chemungensis var. pandora Hall, Pal. New York, IV, 1867, p. 68, pl. 4, figs. 11–19; pl. 9, figs. 18–25, 27;—Second Ann. Rep. N. Y. State Geol., 1883, pl. 40, figs. 1–6.

Orthothetes chemungensis var. pandora Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 255, pl. 9, fig. 30; pl. 10, figs. 1–6.

Loc. Schoharie, Knoxville, Clarksville, etc., New York; Cayuga, Ontario; Columbus, Ohio (Whitfield); Eureka district, Nevada.

Orthothetes pravus Hall. (?Upper) Devonian.

Orthis prava Hall, Geol. Survey Iowa, I, Pt. II, 1858, p. 490.

Orthothetes prava Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 255, pl. 11A, fig. 13.

Loc. Lime Creek, Worth County, Iowa.

Orthothetes subplanus (Conrad). Niagara and L. Held. (Sil. and Dev.).

Strophomena subplana Conrad, Jour. Acad. Nat. Sci., Philadelphia, VIII, 1842, p. 258.—Hall, Geol. N. Y.; Rep. Fourth Dist., 1843, p. 104, fig. 1;—Twelfth Rep. N. Y. State Cab. Nat. Hist., 1859, p. 82.

Leptæna subplana Hall, Pal. New York, II, 1852, p. 259, pl. 53, figs. 8–10.—Billings, Canadian Nat. Geol., I, 1856, p. 138, pl. 2, figs. 16, 17.

Strophomena pecten Roemer, Die Sil. Fauna west. Tennessee, 1860, p. 67, pl. 5, fig. 4.—Billings, Geol. Canada, 1863, p. 311, fig. 315;—Catalogue Silurian Fossils of Anticosti, 1866, p. 40.

Streptorhynchus (Strophodonta) subplanus Hall, Geol. Survey Wisconsin, I, 1862, p. 436.

Streptorhynchus subplanus Hall, Trans. Albany Institute, IV, 1863, p. 226;—Sixteenth Rep. N. Y. State Cab. Nat. Hist., 1863, p. 63, figs. 1, 2;—Twenty-eighth Rep. N. Y. State Mus. Nat. Hist., 1879, p. 151, pl. 21, figs. 26–33;—Eleventh Rep. State Geol. Indiana, 1882, p. 288, pl. 21, figs. 26–33;—Second Ann. Rep. N. Y. State Geol., 1883, pl. 39, figs. 21–24; pl. 42, fig. 19.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 141, pl. 29, figs. 11, 12.—Beecher and Clarke, Mem. N. Y. State Mus., I, 1889, p. 23, pl. 2, figs. 14–20.

Streptorhynchus hemiaster Winchell and Marcy, Mem. Boston Soc. Nat. Hist., I, 1865, p. 93, pl. 2, fig. 10.—Hall, Twentieth Rep. N. Y. State Cab. Nat. Hist., 1867, p. 392.

Hemipronites subplanus Meek and Worthen, Geol. Survey Illinois, III, 1868, p. 349.

Hemipronites propinquus Meek and Worthen, Ibidem, III, 1868, p. 351, pl. 6, fig. 6.

Orthothetes subplana Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 255, pl. 9, figs. 21–24; pl. 9A, fig. 19; pl. 11A, figs. 9–12.

Loc. Lockport, Rochester, etc., New York; Thorold, Ontario; Waldron, Indiana; Louisville, Kentucky; Thebes, Alexander County, and Bridgeport, Illinois; Pike County, Missouri; Decatur County, Tennessee; Arisaig, Nova Scotia (Ami); Anticosti.

Orthothetes tapajotensis (Derby). Upper Carboniferous.

Streptorhynchus tapajotensis Derby, Bull. Cornell Univ., I, 1874, p. 37, pl. 5, figs. 3, 6, 7, 9, 10; pl. 8. fig. 9.

Orthothetes tapajotensis (Derby)—Continued.

Orthothetes tapajotensis Waagen, Palæontologica Indica, Ser. XIII, I, 1884, pp. 607, 608.

Loc. Bomjardim and Itaituba, Brazil.

Orthothetes tenuis Hall. Niagara (Sil.).

Streptorhynchus tenuis Hall, Trans. Albany Institute, IV, 1863, p. 210;—Twenty-eighth Rep. N. Y. State Mus. Nat. Hist., 1879, p. 150, pl. 23, figs. 11–13;—Eleventh Rep. State Geol. Indiana, 1882, p. 287, pl. 23, figs. 11–13.—Foerste, Bull. Denison Univ., II, 1887, p. 105, pl. 8, figs. 31, 32, 38.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 142.

Orthothetes tenuis Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 255.

Strophomena (Orthothetes) tenuis Foerste, Geol. Ohio, VII, 1895, p. 568, pl. 27, figs. 31, 32, 38.

Loc. Waldron, Indiana; near Louisville, Kentucky; Dayton, Ohio.

Orthothetes umbraculum of authors (non von Buch). L. and Up. Carb.

Orthis umbraculum Hall, Stansbury's Expl. Survey Valley Great Salt Lake, Utah, 1852, p. 412, pl. 3, fig. 6.—Newberry, Ives's Rep. Colorado River of the West, 1861, p. 125.

Streptorhynchus umbraculum? A. Winchell, Proc. Acad. Nat. Sci. Philadelphia, 1865, p. 117.

Hemipronites umbraculum? A. Winchell, Proc. American Philosophical Soc., XII, 1870, p. 251.

Orthothetes umbraculum Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 256.

Loc. Waverly group, Newark, Sciotoville, Warren, etc., Ohio; Up. Carb., Leavenworth, Kansas.

Orthothetes woolworthanus Hall. Lower Helderberg (Dev.).

Strophomena woolworthana Hall, Tenth. Rep. N. Y. State Cab. Nat. Hist., 1857, p. 48, figs. 1, 2;—Hall, Pal. New York, III, 1859, p. 192, pl. 17, figs. 1, 2.

Streptorhynchus woolworthana Billings, Geol. Canada, 1863, p. 957, fig. 449.—Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 39, figs. 25–31.

Orthothetes woolworthana Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 255, pl. 9, figs. 25–31.

Loc. Schoharie, Carlisle, Clarksville, and Hudson, New York.

ORTHOTICHIA Hall and C. Genotype Orthis? morganiana Derby.

Orthotichia Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 213;—Eleventh Ann. Rep. N. Y. State Geologist, 1894, p. 272.

Orthotichia morganiana (Derby). Upper Carboniferous.

Orthis? morganiana Derby, Bull. Cornell University, I, 1874, p. 29, pl. 3, figs. 1–9, 11, 34; pl. 4, figs. 6, 14, 15.

Orthis morganiana Waagen, Palæontologica Indica, Ser. XIII, I, 1884, p. 564.

Orthotichia? morganiana Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 213, 226, pl. 7, figs. 11–15.

Loc. Bomjardim and Itaituba, Brazil.

ORTHOTROPIA Hall and Clarke. Genotype O. dolomitica H. and C.

Orthotropia Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, explanation sheet to pl. 84, figs. 3–7.—Thirteenth Ann. Rep. N. Y. State Geol., 1895, p. 943.

Orthotropia dolomitica Hall and Clarke. Niagara (Sil.).

Orthotropia dolomitica Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 84, figs. 3–7.

Loc. Near Milwaukee, Wisconsin.

PARASTROPHIA Hall and C. Genotype Atrypa hemiplicata Hall.

Parastrophia Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 221;—Thirteenth Ann. Rep. N. Y. State Geologist, 1895, p. 839.

Parastrophia divergens Hall and Clarke. Lorraine (Ord.).

Parastrophia divergens Hall and Clarke, Pal. New York. VIII, Pt. II, 1895, pp. 222, 366, pl. 63, figs. 4–7.

Loc. Wilmington, Illinois.

Parastrophia greenei Hall and Clarke. Niagara (Sil.).

Parastrophia greenii Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pp. 222, 367, pl. 63, figs. 17–20, 22.

Loc. Milwaukee, Wisconsin.

Parastrophia hemiplicata Hall. Trenton (Ord.).

Atrypa hemiplicata Hall, Pal. New York, I, 1847, p. 144, pl. 33, fig. 10.—Billings, Canadian Nat. Geol., I, 1856, p. 208, figs. 20–23.

Atrypa circulus Hall, Pal. New York, I, 1847, p. 142, pl. 33, fig. 7;—Twelfth Rep. N. Y. State Cab. Nat. Hist., 1859, p. 65.

Pentamerus hemiplicatus Hall, Twelfth Rep. N. Y. State Cab. Nat. Hist., 1859, p. 66.—Billings, Canadian Jour., IV, 1859, p. 316.

Camarella hemiplicata Billings, Geol. Canada, 1863, p. 168, fig. 154.

Camarella circulus Miller, American Pal. Fossils, 1877, p. 107.

Camarella bernensis Sardeson, Bull. Minnesota Acad. Nat. Sci., III, 1892, p. 328, pl. 4, figs. 4–6.

Anastrophia ? hemiplicata Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 382, pl. 30, figs. 29–31.—Whiteaves, Pal. Foss., III, Pt. III, 1897, p. 167.

Parastrophia hemiplicata Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 221, pl. 63, figs. 1–3.

Loc. Middleville, Watertown, etc., New York; Center County, Pennsylvania; Wisconsin; Minnesota; Ottawa and Lake Winnipeg, Canada.

Parastrophia hemiplicata rotunda (Winchell and Schu.). Trenton (Ord.).

Anastrophia ? hemiplicata var. rotunda W. and S., Minnesota Geol. Survey, III, 1893, p. 383, pl. 30, figs. 32–35.

Loc. Cannon Falls, Minnesota; Decorah, Iowa.

Parastrophia latiplicata Hall and Clarke. Niagara (Sil.).

Parastrophia latiplicata Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pp. 222, 368, pl. 63, figs. 23–27.

Loc. Milwaukee, Wisconsin.

Parastrophia multiplicata Hall and Clarke. Niagara (Sil.).

Parastrophia multiplicata Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pp. 222, 367, pl. 63, figs. 15, 16, 21.

Loc. Milwaukee, Wisconsin.

Parastrophia (?) obscura (Hall and Whitfield). Pogonip (Ord.).

Porambonites obscurus Hall and Whitfield, King's U. S. Geol. Expl. 40th Parl., IV, 1877, p. 234, pl. 1, fig. 16.

Porambonites ? obscurus Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 228.

Loc. White Pine district, Nevada.

Obs. Based upon a single ventral valve which is insufficient to determine whether it belongs to Parastrophia or some rhynchonelloid. It is not a Porambonites.

Parastrophia ops (Billings). Anticosti (Sil.).

Camarella ops Billings, Pal. Fossils, I, 1862, p. 148, fig. 128.

Loc. Anticosti.

Obs. May be only a variety of P. reversa.

Parastrophia reversa (Billings). Anticosti (Sil.).

Pentamerus reversus Billings, Geol. Survey Canada; Rep. Progress for 1856, 1857, p. 295;—Canadian Jour., IV, 1859, p. 316.

Brachymerus reversus Shaler, Bull. Mus. Comp. Zool., 4, 1865, p. 69.

Anastrophia reversa Miller, American Pal. Foss., 1877, p. 104.

Parastrophia reversa Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 63, figs. 8–14.

Loc. Anticosti.

Obs. Billings says this species is a large P. hemiplicata Hall. It appears, however, to be distinct. See P. ops Billings.

Parastrophia scofieldi (Winchell and Schuchert). Trenton (Ord.).

Anastrophia ? scofieldi W. and S., Minnesota Geol. Survey, III, 1893, p. 383, pl. 30, figs. 24–28.

Loc. Near Cannon Falls, Minnesota.

PARAZYGA Hall and Clarke. Genotype Atrypa hirsuta Hall.

Parazyga Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 127;—Thirteenth Ann. Rep. N. Y. State Geologist, 1895, p. 800.

Parazyga deweyi Hall. Lower Helderberg (Dev.).

Waldheimia deweyi Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 89.

Trematospira (Rhynchospira) deweyi Hall, Pal. New York, III, 1889, p. 216, pl. 36, fig. 3.

Parazyga deweyi Hall and Clarke, Ibidem, VIII, Pt. II, 1893, p. 128, fig. 112, pl. 49, figs. 40–46.

Loc. Albany and Schoharie counties, New York.

Parazyga hirsuta Hall. Corniferous and Hamilton (Dev.).

Atrypa hirsuta Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 168.

Trematospira hirsuta Hall, Thirteenth Rep. Ibidem, 1860, p. 101;—Fourteenth Rep. Ibidem, 1861, p. 101;—Fifteenth Rep. Ibidem, 1862, pl. 2, figs. 11–16;—Pal. New York, IV, 1867, p. 274, pl. 45, figs. 16–32.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 136, pl. 16, figs. 15–19.

Athyris ? chloe Billings, Canadian Jour., n. ser., V, 1860, p. 282, figs. 45–47.

Retzia chloe Billings, Geol. Canada, 1863, p. 385, fig. 419.

Nucleospira indianensis Miller, Seventeenth Rep. State Geol. Indiana, 1892, p. 79, pl. 13, figs. 13–15.

Parazyga hirsuta Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, p. 128, fig. 111; pl. 49, figs. 28–39.

Loc. New York; Thedford, Canada; Falls of Ohio; Bunker Hill, Indiana.

Paterina Beecher=Iphidea.

PATERULA Barrande. Genotype Paterula bohemica Barrande.

Paterula Barrande, Système Sil. du Centre de la Bohéme, V, 1879, p. 110.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 78, 165;—Eleventh Ann. Rep. N. Y. State Geologist, 1894, p. 242.

Paterula amii n. sp. Calciferous (Ord.).

Paterula species Hall and Clarke, VIII, Pt. I, p. 78, pl. 4K, fig. 1.

Loc. Quebec, Canada.

PENTAGONIA Cozzens. Genotype Pentagonia peersii Cozzens= Atrypa unisulcata Conrad.

Pentagonia Cozzens, Annals Lyceum Nat. Hist. N. Y., IV, 1846, p. 158.—Meek and Hayden, Smithsonian Cont. Knowledge, XIV, 172, 1864, p. 16.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, p. 80;—Thirteenth Ann. Rep. N. Y. State Geologist, 1895, p. 775.

Goniocœlia Hall, Fourteenth Rep. N. Y. State Cab. Nat. Hist., 1861, p. 101.

Pentagonia peersii Cozzens=Pentagonia unisulcata.

Pentagonia unisulcata (Conrad). Oriskany to Hamilton (Dev.).

Atrypa unisulcata Conrad, Fifth Ann. Rep. Geol. Survey of N. Y., 1841, p. 56.—Hall, Fifteenth Rep. N. Y. State Cab. Nat. Hist., 1862, pl. 11, fig. 10.

Pentagonia peersii Cozzens, Annals Lyceum Nat. Hist. N. Y., IV, 1846, p. 158, pl. 10, fig. 3.

Rhynchonella unisulcata Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 125.

Athyris? unisulcata Billings, Canadian Journal, V, 1860, p. 279, figs. 39–42.

Goniocœlia uniangulata Hall, Fourteenth Rep. N. Y. State Cab. Nat. Hist., 1861, p. 101.

Meristella ? unisulcata Hall, Fifteenth Rep. Ibidem, 1862, pl. 2, figs. 17–25.

Athyris unisulcata Billings, Geol. Canada, 1863, p. 373, fig. 396.

Meristella (Pentagonia) unisulcata varieties biplicata and uniplicata Hall, Pal. New York, IV, 1867, p. 309, pl. 50, figs. 18–35.

Meristella unisulcata Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 99, pl. 15, figs. 9–16.

Pentagonia unisulcata Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, p. 80, pl. 42, figs. 22–32.

Loc. New York; county of Haldimand and Bosanquet, Ontario; Falls of Ohio.

PENTAMERELLA Hall. Genotype Atrypa arata Conrad.

Pentamerella Hall, Twentieth Rep. N. Y. State Cab. Nat. Hist., 1867, p. 163;—Pal. New York, IV, 1867, pp. 373, 375.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 49.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 245;—Thirteenth Ann. Rep. N. Y. State Geologist, 1895, p. 845.

Pentamerella arata (Conrad). Upper Helderberg (Dev.).

Atrypa arata Conrad, Fifth Ann. Rep. Geol. Survey N. Y., 1841, p. 55.

Atrypa octocostata Conrad, Ibidem, 1841, p. 55.

Pentamerus aratus Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 120, figs. 1–10.—Billings, Canadian Journal, VI, 1861, p. 269, figs. 93–96;—Geol. Canada, 1863, p. 370, fig. 389.

Pentamerella arata Hall, Pal. New York, IV, 1867, p. 375, pl. 58, figs. 1–21.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 49, pl. 13, figs. 17–20.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 245, pl. 71, figs. 21–29.

? Pentamerus aratus Tschernyschew, Mém. Comité Géologique de St. Pétersbourg, III, 1887, p. 101, pl. 4, figs. 18, 19.

Loc. New York; Cayuga, etc., Ontario; Columbus, Ohio; Falls of Ohio; ? Urals of Russia.

Pentamerella borealis (Meek). Hamilton (Dev.).

Pentamerus borealis Meek, Trans. Chicago Acad. Sci., I, 1868, p. 95, pl. 13, fig. 11.

Loc. Anderson River, British America.

Pentamerella (?) compressa Ringueberg. Niagara (Sil.).

Pentamerella compressa Ringueberg, Bull. Buffalo Soc. Nat. Sci., V, 1886, p. 15, pl. 2, fig. 4.

Pentamerella (?) compressa Ringueberg—Continued.

Loc. Lockport, New York.

Obs. May be a pathologic or compressed specimen of Spirifer crispus or S. sulcatus.

Pentamerella dubia Hall. ? Hamilton (Dev.).

Atrypa (n. sp.?) Owen, Geol. Survey Wisconsin, Iowa, Minnesota, 1852, pl. 3A, fig. 1. [See specimen in U. S. Nat. Mus., Cat., Invert. Foss., 17927.]

Spirifer dubius Hall, Thirteenth Rep. N. Y. State Cab. Nat. Hist., 1860, p. 90.

Pentamerella dubia Hall, Pal. New York, IV, 1867, p. 379, pl. 58, figs. 38–43.—Hall and Clarke, Ibidem, VIII, Pt. II, 1893, p. 245, pl. 71, figs. 32–38.

Loc. Iowa City, Iowa.

Obs. See Pentamerella micula Hall.

Pentamerella intralineata (A. Winchell). Hamilton (Dev.).

Pentamerus intralineatus A. Winchell, Geol. Rep. Lower Peninsula of Michigan, 1866, p. 94.

Loc. Grand Traverse region, Michigan.

Pentamerella micula Hall. ? Hamilton (Dev.).

Pentamerella micula Hall, Pal. New York, IV, 1867, p. 378, pl. 58, figs. 26, 27.—Hall and Clarke, Ibidem, VIII, Pt. II, 1893, p. 245.

Loc. Iowa City, Iowa.

Obs. Compare with Pentamerella dubia Hall.

Pentamerella obsolescens Hall. ? Hamilton (Dev.).

Pentamerella obsolescens Hall, Pal. New York, IV, 1867, p. 379, pl. 58, figs. 24, 25.—Hall and Clarke, Ibidem, VIII, Pt. II, 1893, p. 245.

Loc. Waterloo, Iowa.

Pentamerella pavilionensis Hall. Hamilton (Dev.).

Pentamerus papilionensis Hall, Thirteenth Rep. N. Y. State Cab. Nat. Hist., 1860, p. 86.

Pentamerella papilionensis Hall, Pal. New York, IV, 1867, p. 377, pl. 58, figs. 28–37.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 50.

Pentamerella pavilionensis Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 245, pl. 71, figs. 30, 31.

Loc. Seneca and Canandaigua lakes, etc., New York; Falls of Ohio.

Pentamerella thusnelda Nettelroth. Corniferous (Dev.).

Pentamerella thusnelda Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 51, pl. 31, figs. 26–28.

Loc. Near Louisville, Kentucky.

Pentamerella ventricosa Hall=Clorinda ventricosa.

PENTAMERUS Sowerby. Genotype P. lævis Sowerby.

Pentamerus Sowerby, Mineral Conchology, I, 1813, p. 76.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, p. 236;—Thirteenth Ann. Rep. N. Y. State Geologist, 1895, p. 844.

Pentamerus arcuosus McChesney=Clorinda arcuosa.

Pentamerus aratus=Pentamerella arata.

Pentamerus barrandi Billings=Clorinda barrandei.

Pentamerus beaumonti Castelnau=P. oblongus.

Pentamerus bisinuatus McChesney=P. oblongus.

Pentamerus borealis Meek=Pentamerella borealis.

Pentamerus brevirostris Hall=Anastrophia brevirostris.

Pentamerus chicagoensis Winchell and Marcy=Clorinda ventricosa.
Pentamerus colletti Miller=Conchidium colletti.
Pentamerus comis Meek and Worthen=Gypidula comis.
Pentamerus complanatus Nettelroth=Conchidium tenuicostatum.
Pentamerus conchidium=Conchidium biloculare.
Pentamerus coppingeri Etheridge=Gypidula coppingeri.
Pentamerus crassoradius McChesney=Conchidium crassiradiatum.
Pentamerus decussatus Whiteaves=Conchidium decussatum.
Pentamerus deshayessii Castelnau=Rensselæria ovoides.
Pentamerus elongatus Vanuxem=Amphigenia elongata.
Pentamerus fornicatus Hall=Clorinda fornicata.
Pentamerus galeatiformis Meek and Worthen=Gypidula comis.
Pentamerus galeatus Hall=Gypidula galeata.
Pentamerus galeatus Hall and Whitfield=Gypidula nucleus.
Pentamerus galeatus Roemer=Gypidula rœmeri.
Pentamerus globulosus Nettelroth=Gypidula globulosa.
Pentamerus hemiplicatus Billings=Parastrophia hemiplicata.
Pentamerus interplicatus Hall=Anastrophia interplicata.
Pentamerus intralineatus Winchell=Pentamerella intralineata.
Pentamerus knappi Hall and Whitfield=Conchidium knappi.
Pentamerus knighti Sowerby=Conchidium knighti.
Pentamerus knotti Nettelroth=Gypidula knotti.
Pentamerus laqueatus Conrad=Conchidium laqueatum.
Pentamerus lenticularis White and Whitfield=Camarophorella lenticularis.
Pentamerus littoni Hall=Conchidium littoni.
Pentamerus lotis Walcott=Gypidula lotis.
Pentamerus multicostatus=Conchidium multicostatum.
Pentamerus nobilis Emmons=Conchidium laqueatum.
Pentamerus nucleus Hall and Whitfield=Gypidula nucleus.
Pentamerus nysius var. crassicosta Hall=Conchidium nysius.
Pentamerus nysius var. tenuicostatus Nettelroth=Conchidium nysius.
Pentamerus nysius var. tenuicosta Hall=Conchidium tenuicosta.

Pentamerus oblongus Sowerby. Clinton and Niagara (Sil.).

Pentamerus oblongus Sowerby, Murchison's Silurian System, 1839, p. 641, pl. 19, fig. 10.—Hall, Geol. N. Y.; Rep. Fourth Dist., 1843, p. 70, figs. 1-5.—Owen, Geol. Expl. Iowa, Wisconsin and Illinois, 1844, pl. 14, fig. 10.—Hall, American Jour. Sci., 2d ser., XX, 1849, p. 227;—Pal. New York, II, 1852, p. 79, pl. 25, fig. 1; pl. 26, fig. 1.—Billings, Canadian Nat. Geol., I, 1856, p. 58, pl. 1, figs. 2, 3;—Geol. Canada, 1863, p. 316, fig. 326.—Hall and Whitfield, Twenty-fourth Rep. N. Y. State Cab. Nat. Hist., 1872, p. 183;—Geol. Survey Ohio, Pal., II, 1875, p. 137, pl. 7, fig. 9.—Whitfield, Geol. Wisconsin, IV, 1882, p. 288, pl. 17, figs. 4-9.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 60, pl. 33, figs. 15-17.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, p. 237, figs. 169-171; pl. 67, fig. 20; pl. 68, figs. 1-5; pl. 69, figs. 1, 4-7, 13, 14; pl. 70, figs. 1-4.

Pentamerus beaumonti Castelnau, Essai Syst. Sil. l'Amérique Septentrionale, 1843, p. 38, pl. 13, fig. 9.

Pentamerus oblongus Sowerby—Continued.

Pentamerus bisinuatus McChesney, Descriptions New Pal. Foss., 1861, p. 85;—Trans. Chicago Acad. Sci., I, 1868, pl. 9, fig. 1.—Whitfield, Geol. Wisconsin, IV, 1882, p. 290, pl. 17, fig. 3.

Loc. England; New York; Ohio; Indiana; Kentucky; Illinois; Iowa; Wisconsin; Thorold, Ontario; Anticosti.

Pentamerus oblongus cylindricus Hall and Whitfield. Niagara (Sil.).

Pentamerus oblongus var. cylindrica Hall and Whitfield, Twenty-fourth Rep. N. Y. State Cab. Nat. Hist., 1872, p. 183;—Twenty-seventh Rep. Ibidem, 1875, pl. 10, figs. 13, 14.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 61, pl. 30, figs. 2–4.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 237, fig. 172; pl. 68, figs. 7, 8; pl. 69, figs. 11, 12.

Loc. Louisville, Kentucky.

Pentamerus oblongus maquoketa Hall and Clarke. Niagara (Sil.).

Pentamerus oblongus (partim) Whitfield, Geol. Wisconsin, IV, 1882, pp. 288, 291, pl. 17, figs. 8, 9.

Pentamerus oblongus var. maquoketa Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 239, pl. 67, figs. 11–13.

Loc. Ashford, Wisconsin; near Dubuque and Hopkinton, Iowa.

Pentamerus oblongus subrectus Hall and Clarke. Niagara (Sil.).

Pentamerus oblongus var. subrectus Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pp. 238, 239, pl. 68, fig. 6; pl. 69, figs. 2, 3, 8–10; pl. 70, fig. 5.

Loc. Earlville, Iowa; Wisconsin.

Pentamerus occidentalis Hall, 1858 (non 1852)=Gypidula comis.

Pentamerus occidentalis Hall, 1852=Conchidium occidentale.

Pentamerus ovalis Hall. Clinton (Sil.).

Pentamerus ovalis Hall, Pal. New York, II, 1852, p. 103, pl. 31, fig. 1.—Foerste, Proc. Boston Soc. Nat. Hist., XXIV, 1890, p. 324, pl. 5, figs. 17, 18.

Loc. New Hartford, Oneida County, New York; Cumberland Gap, Tennessee; Collinsville, Alabama.

Obs. Compare with P. oblongus.

Pentamerus papilionensis Hall=Pentamerella pavilionensis.

Pentamerus pergibbosus Hall and Whitfield. Niagara (Sil.).

Pentamerus pergibbosus Hall and Whitfield, Pal. Ohio, II, 1875, p. 139, pl. 7, figs. 10, 11.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 162 —Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 239, pl. 67, figs. 10, 14–19.

Loc. Greenfield, Ohio; Louisville, Kentucky; Wisconsin (Whitfield).

Pentamerus pesovis Whitfield. Waterlime (Sil.).

Pentamerus pesovis Whitfield, Annals N. Y. Acad. Sci., II, 1882, p. 195;—Ibidem, V, 1891, p. 513, pl. 5, figs. 11–22;—Geol. Ohio, VII, 1895, p. 414, pl. 1, figs. 18–22.

Loc. Greenfield, Ohio; Louisville, Kentucky; Wisconsin (Whitfield).

Pentamerus pseudogaleatus Hall=Gypidula pseudogaleata.

Pentamerus reversus Billings=Parastrophia reversa.

Pentamerus salinensis Swallow=Conchidium saliense.

Pentamerus subglobosus Meek and Worthen=Gypidula subglobosa.

Pentamerus trisinuatus McChesney=Meristina trisinuata.

Pentamerus uniplicatus Nettelroth=Gypidula uniplicata.

Pentamerus ventricosus Hall=Clorinda ventricosa.

Pentamerus verneuili Hall=Anastrophia verneuili.

PHOLIDOPS Hall. Genotype Orbicula squamiformis Hall.

Pholidops Hall, Pal. New York, III, 1859, p. 489;—Thirteenth Rep., N. Y. State Cab. Nat. Hist., 1860, p. 92;—Fifteenth Rep. Ibidem, 1862, p. 195;—Pal. New York, IV, 1867, pp. 31, 413.—Dall, Bull. Mus. Comp., Zool., III, 1871, p. 27.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 155.—Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 376.—Hall and Clarke, Eleventh Rep. N. Y. State Geologist, 1894, p. 262.

Craniops Hall, Twelfth Rep. N. Y. State Cab. Nat. Hist., 1859, p. 84.—Œhlert, Fischer's Manuel de Conchyliologie, 1887, p. 1272.

Pholidops arenaria Hall. Oriskany (Dev.).

Pholidops arenaria Hall, Pal. New York, IV, 1867, p. 413, pl. 3, fig. 10.—Hall and Clarke, Ibidem, VIII, Pt. I, 1892, pl. 4I, fig. 24.

Loc. Albany County and Hudson, New York.

Pholidops areolata Hall. Schoharie (Dev.).

Pholidops areolata Hall, Sixteenth Rep. N. Y. State Cab. Nat. Hist., 1863, p. 31;—Pal. New York, IV, 1867, p. 31, pl. 3, figs. 4, 5.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 41, figs. 25, 26.

Loc. Clarksville and Knox, New York.

Pholidops bellula Walcott. Lower Devonian.

Pholidops bellula Walcott, Mon. U. S. Geol Survey, VIII, 1884, p. 113, pl. 2, fig. 6.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 157.

Loc. Eureka district, Nevada.

Pholidops calceola Hall and Clarke. Corniferous (Dev.).

Pholidops calceola Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 157, 182, pl. 4I, fig. 30.

Loc. Falls of Ohio.

Pholidops cincinnatiensis Hall. Lorraine (Ord.).

Pholidops cincinnatiensis Hall, Twenty-fourth Rep. N. Y. State Cab. Nat. Hist., 1872, pl. 7, fig. 10;—Pal. Ohio, I, 1873, p. 130, pl. 5, fig. 2.—Miller, Cincinnati Quart. Jour. Science, II, 1875, p. 14;—Jour. Cincinnati Soc. Nat. Hist., I, 1878, p. 107.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 157, pl. 4I, fig. 18.

Loc. Cincinnati, etc., Ohio.

Pholidops greenei Miller and Gurley. Hamilton (Dev.).

Pholidops greenei Miller and Gurley, Bull. Illinois State Mus. Nat. Hist., 12, 1897, p. 48, pl. 3, figs. 16–21.

Loc. Falls of Ohio.

Pholidops hamiltoniæ Hall. Hamilton (Dev.).

Pholidops hamiltoniæ Hall, Thirteenth Rep. N. Y. State Cab. Nat. Hist., 1860, p. 92;—Pal. New York, IV, 1867, p. 32, pl. 3, figs. 6–9.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 157, pl. 4I, figs. 31–34 (37?).

Loc. Darien, Moscow, Canandaigua Lake, etc., New York.

Pholidops lamellosa Hall=Pholidops oblata.

Pholidops lepis Hall and Clarke. Corniferous (Dev.).

Pholidops lepis Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 157.

Loc. Not given.

Obs. A nomina nudum.

Pholidops linguloides Hall=Pholidops oblata.

Pholidops oblata Hall. Hamilton (Dev.).

Pholidops oblata Hall, Pal. New York, IV, 1867, p. 414, pl. 3, fig. 10.
Pholidops (?) linguloides Hall, Ibidem, 1867, p. 414.
Pholidops lamellosa Hall, Ibidem, 1867, pl. 3, fig. 11.
Pholidops linguloides and oblata Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 157, pl. 4I, figs. 35, 36.
Loc. Aurora and Canandaigua Lake, New York.

Pholidops ovalis Hall. Niagara (Sil.).

Pholidops ovalis Hall, Trans. Albany Institute, IV, 1863, p. 209;—Pal. New York, IV, 1867, pl. 3, figs. 1, 2;—Twenty-eighth Rep. N. Y. State Mus. Nat. Hist., 1879, p. 149, pl. 21, figs. 1, 2;—Eleventh Rep. State Geol. Indiana, 1882, p. 284, pl. 21, figs. 1, 2.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 157, pl. 4I, fig. 20.
Loc. Waldron, Indiana; Arisaig, Nova Scotia (Ami).
Obs. This species and P. squamiformis are probably identical with P. implicata Sowerby.

Pholidops ovata Hall. Lower Helderberg (Dev.).

Pholidops ovatus Hall, Pal. New York, III, 1859, p. 490, pl. 103B, fig. 7.
Pholidops ovata Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 157, pl. 4I, figs. 22, 23.
Loc. Albany County, New York; ? Square Lake, Maine.

Pholidops patina Hall and Clarke. Corniferous (Dev.).

Pholidops patina Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 182, pl. 4I, figs. 27-29.
Loc. De Cewville, Ontario.

?Pholidops quadrangularis Walcott. Lower Devonian.

Pholidops quadrangularis Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 114, pl. 2, fig. 7.
Loc. Lone Mountain, Nevada.
Obs. Apparently a plate of a crinoid.

Pholidops squamiformis Hall. Niagara (Sil.).

Orbicula ? squamiformis Hall, Geol. N. Y.; Rep. Fourth Dist., 1843, p. 108, fig. 1;—Pal. New York, II, 1852, p. 250, pl. 53, fig. 4.
Craniops squamiformis Hall, Twelfth Rep. N. Y. State Cab. Nat. Hist., 1859, p. 84.
Pholidops squamiformis Hall, Pal. New York, III, 1859, p. 490, pl. 103B, fig. 6.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 156, pl. 4I, fig. 21.
Loc. Lockport, Rochester, etc., New York.
Obs. See Pholidops ovalis Hall.

Pholidops subtruncata Hall. Lorraine (Ord.).

Orbicula ? subtruncata Hall, Pal. New York, I, 1847, p. 290, pl. 79, fig. 7.
Pholidops subtruncata Hall, Descrip. n. sp. of Crinoidea and other Fossils, 1866, p. 14;—Twenty-fourth Rep. N. Y. State Cab. Nat. Hist., 1872, p. 221, pl. 7, fig. 9.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 4I, fig. 19.
Loc. Lorraine and Turin, New York. In the Trenton at Ottawa, Canada (Ami).

Pholidops terminalis Hall. Oriskany (Dev.).

Pholidops terminalis Hall, Pal. New York, III, 1859, p. 490, pl. 103B, fig. 8.—Hall and Clarke, Ibidem, VIII, Pt. I, 1892, p. 157.
Loc. Cumberland, Maryland.

Pholidops trentonensis Hall. Trenton (Ord.).

Pholidops trentonensis Hall, Descrip. n. sp. of Crinoidea and other Fossils, 1866, p. 14;—Twenty-fourth Rep. N. Y. State Cab. Nat. Hist., 1872, p. 221, pl. 7, fig. 8.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 157, pl. 4I, fig. 17.
Loc. Middleville, New York.

Pholidops trentonensis minor Winchell and Schuchert. Trenton (Ord.).

Pholidops trentonensis var. minor Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 376, pl. 29, fig. 40.

Loc. St. Paul and Cannon Falls, Minnesota.

PHOLIDOSTROPHIA Hall and Clarke. Genotype Strophodonta nacrea Hall=Chonetes (?) iowensis Owen.

Pholidostrophia Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 287;—Eleventh Ann. Rep. N. Y. State Geologist, 1894, p. 281.

Pholidostrophia iowaensis (Owen). Corniferous and Hamilton (Dev.).

Chonetes (?) iowensis Owen, Geol. Survey Wisconsin, Iowa, Minnesota, 1852, p. 584, pl. 3A, fig. 7. [See specimens in U. S. Nat. Mus., Cat. Invert. Foss., 17942.]

Chonetes sp. undet. Owen, Ibidem, 1852, pl. 3A, fig. 17. [See specimens in U. S. Nat. Mus., Cat. Invert. Foss., 17916.]

Strophomena (Strophodonta) nacrea Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 144.

Strophomena lepida Hall, Geol. Iowa, I, 1858, p. 493, pl. 3, fig. 3.—Billings, Canadian Jour. Sci. Arts, VI, 1861, p. 344.

Strophodonta nacrea Hall, Pal. New York, IV, 1867, p. 104, pl. 18, fig. 1;—Second Ann. Rep. N. Y. State Geol., 1883, pl. 46, figs. 20–24.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 146.

Stropheodonta (Pholidostrophia) nacrea Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 287, pl. 15, figs. 20–24; Pt. II, 1895, pl. 84, fig. 11.

Loc. Iowa City, Iowa; western New York; Columbus, Ohio; Falls of Ohio; Rock Island, Illinois; Alpena, Michigan; Ontario, Canada.

Obs. Owen's type specimens preserved in the United States National Museum prove to be identical with Strophomena lepida, which Hall in 1867 said is a synonym for Stropheodonta nacrea.

Plæsiomys Hall and Clarke=Dinorthis.

PLATYSTROPHIA King. Genotype Terebratulites biforata Schlotheim.

Platystrophia King, Mon. Permian Fossils of England, Pal. Soc., 1850, p. 116.—Hall, Geol. Soc. America, I, 1889, pp. 19, 20.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 200.—Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 454.—Hall and Clarke, Eleventh Ann. Rep. N. Y. State Geologist, 1894, p. 268.

Obs. It is doubtful whether all the various forms of Platystrophia can be regarded as species. This genus is nearly always abundantly represented by one or more forms throughout the American Ordovician and Silurian systems. When individuals of the same region or of widely separated localities are compared with each other it is apparent that the specific characters are very inconstant. Individuals of a stratum, however, are fairly constant in form, size, and plications, and it is this limited constancy that has served in many of the following species.

Platystrophia acuminata James. Lorraine (Ord.).

Orthis (Platystrophia) acuminata James, The Palæontologist, 1, 1878, p. 7.

Loc. Cincinnati, Ohio.

Platystrophia acutilirata (Conrad). Lorraine (Ord.).

Delthyris acutilirata Conrad, Jour. Acad. Nat. Sci. Philadelphia, VIII, 1842, p. 260, pl. 14, fig. 15.

Orthis (Platystrophia) acutilirata Meek, Pal. Ohio, I, 1873, p. 119, pl. 10, fig. 5.

Orthis acutilirata Miller, Cincinnati Quart. Jour. Sci., II, 1875, p. 28.

Platystrophia acutilirata (Conrad)—Continued.

Orthis biforata var. acutilirata White, Second Ann. Rep. Indiana Bureau of Statistics and Geol., 1880, p. 487, pl. 2, figs. 5–9;—Tenth Rep. State Geol. Indiana, 1881, p. 119, pl. 2, figs. 5–9.

Platystrophia acutilirata Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 223.

Loc. Richmond, Indiana; Oxford, Ohio; Louisiana, Missouri (Keyes).

Platystrophia biforata (Schlotheim). Chazy-Niagara (Ord. and Sil.).

Terebratulites biforatus Schlotheim, Petrefactenkunde, 1820, p. 265.

Spirifer sheppardi Castelnau, Essai Syst. Sil. l'Amérique Septentrionale, 1843, p. 42, pl. 14, fig. 15.

Delthyris brachynota Hall, Geol. New York; Rep. Fourth Dist., 1843, p. 70, fig. 6.

Orthis and Delthyris Owen, Geol. Expl. Iowa, Wisconsin, Illinois, 1844, pl. 15, figs. 3, 7.

Delthyris lynx Hall (partim; non Eichwald), Pal. New York, I, 1847, p. 133, pl. 32D, fig. 1.

Spirifer biforata var. lynx Hall, Ibidem, II, 1852, p. 65, pl. 22, fig. 1.

Orthis biforatus Billings, Canadian Nat. Geol., I, 1856, p. 206, figs. 6–10.—Nicholson and Hinde, Canadian Jour., XIV, 1874, p. 158.—White, Rep. U. S. Geogr. Geol. Survey west 100th Meridian, IV, 1874, p. 74, pl. 4, fig. 9.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 35, pl. 29, figs. 18–29.—Foerste, Proc. Boston Soc. Nat. Hist., XXIV, 1890, p. 312.

Orthis lynx Billings, Geol. Canada, 1863, p. 167, fig. 149.—Miller (partim), Cincinnati Quart. Jour. Sci., II, 1875, p. 25.

Platystrophia regularis Shaler, Bull. Mus. Comp. Zool., 4, 1865, p. 67.

Orthis (Platystrophia) biforata Meek, Pal. Ohio, I, 1873, p. 112.—Foerste, Geol. Ohio, VII, 1895, p. 579, pl. 25, figs. 7, 8.

Orthis (Platystrophia) biforata var. lynx Hall, Second Ann. Rep. N. Y. State Geologist, 1883, pl. 35, figs. 11–14 (non figs. 9, 10, 15 of pl. 35 and fig. 30, pl. 34 = P. biforata lynx).

Orthis biforata var. lynx forma reversata and daytonensis Foerste, Bull. Denison Univ., I, 1885, pp. 81, 82, pl. 13, figs. 7, 8.

Platystrophia lynx Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 202, 223, pl. 5B, fig. 10.—Keyes, Geol. Survey Missouri, V, 1895, p. 64, pl. 39, fig. 5.

Platystrophia biforata Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 455, pl. 33, figs. 51–54.—Whiteaves, Pal. Foss., III, Pt. III, 1897, p. 177.

Loc. Throughout the horizons mentioned above in North America; also in England, Scotland, Ireland, Gotland, Scandinavia, Oeland, and Russia.

Platystrophia crassa James. Lorraine (Ord.).

Orthis (Platystrophia) dentata?? Meek (non Pander), Pal. Ohio, I, 1873, p. 117, pl. 10, fig. 3.

Orthis (Platystrophia) crassa James, Cincinnati Quart. Jour. Sci., I, 1874, p. 20.

Orthis dentata Miller, Ibidem, II, 1875, p. 27.

Orthis centrosa Miller, North American Geol. Pal., 1889, p. 356.

Platystrophia crassa Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 223.

Platystrophia biforata var. crassa Winchell and Schuchert, Geol. Survey Minnesota, III, 1893, p. 458, pl. 33, figs. 55, 56.—Whiteaves, Pal. Foss., III, Pt. III, 1897, p. 178.

Loc. Cincinnati, Ohio; Spring Valley, Minnesota; Lake Winnipeg, Manitoba.

Platystrophia laticosta Meek. Lorraine (Ord.).

Orthis (Platystrophia) laticosta (James) Meek, Pal. Ohio, I, 1873, p. 116, pl. 10, fig. 4.

Orthis (Platystrophia) cypha James, Cincinnati Quart. Jour. Sci., I, 1874, p. 20.

Platystrophia laticosta Meek—Continued.

Orthis laticosta Miller, Cincinnati Quart. Jour. Sci., II, 1875, p. 27.

Platystrophia biforata var. laticosta Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 223, pl. 5B, figs. 5–9

Loc. Cincinnati, etc., Ohio.

Platystrophia lynx (Eichwald). Lorraine (Ord.).

Terebratula lynx Eichwald, Skizze von Podolis, 1830, p. 202.

Delthyris lynx (partim) Hall, Pal. New York, I, 1847, p. 133, pl. 32D, fig. 1.—Rogers, Geol. Pennsylvania, II, Pt. II, 1858, p. 820, fig. 616.

Orthis (Platystrophia) biforata var. lynx Meek, Pal. Ohio, I, 1873, p. 114, pl. 10, fig. 1.—Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 35, figs. 9, 10, 15.

Orthis lynx (partim) Miller, Cincinnati Quart. Jour. Sci., II, 1875, p. 25.

Orthis biforata Nicholson, Pal. Province Ontario, 1875, p. 16, fig. 5.

Orthis (Platystrophia) lynx Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 34, fig. 30.

Platystrophia biforata var. lynx Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 202, 223, pl. 5B, figs. 1–4.

Loc. Cincinnati, Ohio, and elsewhere in the Ohio Valley.

Platystrophia regularis Shaler=Platystrophia biforata.

PLECTAMBONITES Pander. Genotype P. planissima Pander.

Plectambonites Pander, Beitrage zur Geognosie des Russ. Reiches, 1830, p. 90, pl. 3, figs. 8, 16; pl. 28, fig. 19.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 236, 295.—Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 413.—Hall and Clarke, Eleventh Ann. Rep. N. Y. State Geologist, 1894, p. 290.

Plectambonites arca Shaler=Plectambonites transversalis.

Plectambonites gibbosus Winchell and Schuchert. Trenton (Ord.).

Plectambonites gibbosa W. and S., American Geol., IX, 1892, p. 288;—Minnesota Geol. Survey, III, 1893, p. 416, pl. 32, figs. 13–17.

Loc. Mantorville, Old Concord, and near Cannon Falls, Minnesota.

Plectambonites glaber Shaler. Anticosti (Sil.).

Plectambonites glaber Shaler, Bull. Mus. Comp. Zool., 4, 1865, p. 64.

Leptæna glabra Foerste, Proc. Boston Soc. Nat. Hist., XXIV, 1890, p. 294.

Loc. Anticosti.

Plectambonites plicatellus (Ulrich). Utica (Ord.).

Leptæna plicatella Ulrich, Jour. Cincinnati Soc. Nat. Hist., I, 1879, p. 15, pl. 7, fig. 12.

Plectambonites plicatella Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 15A, figs. 34, 35.

Loc. Cincinnati, Ohio; Covington, Kentucky.

Plectambonites productus Hall and Clarke. Niagara (Sil.).

Plectambonites producta Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, p. 360, pl. 84, figs. 23–25.

Loc. Yellow Springs, Ohio.

Plectambonites sericeus (Sowerby). Trenton to Clinton (Ord.-Sil.).

Leptæna sericea J. de C. Sowerby, Murchison's Silurian System, 1839, pl. 19, figs. 1, 2.—Hall, Pal. New York, I, 1847, pp. 110, 287, pl. 31B, fig. 2; pl. 79, fig. 3;—Ibidem, II, 1852, p. 59, pl. 21, fig. 1.—Billings, Canadian Nat. Geol., I, 1856, p. 41, fig. 2.—Rogers, Geol. Pennsylvania, II, Pt. II, 1858, p. 818, fig. 599.—Billings, Geol. Canada, 1863, p. 163, fig. 139.—Meek, Pal. Ohio, I, 1873, p. 70, pl. 5, fig. 3.—Miller, Cincinnati Quart. Jour. Sci., II, 1875, p. 57.—Kayser, Palæontographica, Suppl., III, 1876, p. 21, pl. 3, fig. 19.—Hall, Second Ann. Rep.

Plectambonites sericeus (Sowerby)—Continued.

N. Y. State Geol., 1883, pl. 46, figs. 25–29.—Foerste, Proc. Boston Soc. Nat. Hist., XXIV, 1890, p. 293.—Keyes, Geol. Survey Missouri, V, 1895, p. 75, pl. 39, fig. 9.

Leptæna sericea? White, Wheeler's Expl. Survey west of the 100th Merid., IV, 1875, p. 70, pl. 4, fig. 7.

Strophomena sericea Conrad, Third Ann. Rep. Geol. Survey N. Y., 1840, p. 201.—Emmons, Geol. N. Y.; Rep. Second Dist., 1842, p. 394.

Strophomena semiovalis Vanuxem, Geol. N. Y.; Rep. Third Dist., 1842, p. 47.

Leptæna aspera James, Cincinnati Quart. Jour. Sci., I, 1874, p. 151.

Plectambonites sericea, Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 15, figs. 25–29.—Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 414, pl. 32, figs. 10–12.—Whiteaves, Pal. Foss., III, Pt. III, 1897, p. 174.

Leptæna minnesotensis Sardeson, Minnesota Acad. Nat. Sci., III, 1892, p. 329, pl. 4, figs. 24, 25.

Leptæna precosis Sardeson, Ibidem, 1892, p. 329, pl. 4, figs. 26–28.

Leptæna recedens Sardeson, Ibidem, 1892, p. 330, pl. 4, figs. 29–32.

Leptæna saxea Sardeson, Ibidem, 1892, p. 330, pl. 4, figs. 33–35.

Loc. England; New York; Ohio; Indiana; Kentucky; Missouri; Wisconsin; Minnesota; Manitoba; Talacastra, Argentine Republic.

Plectambonites tenera Shaler=Plectambonites transversalis.

Plectambonites transversalis (Wahlenberg). Clinton-Niagara (Sil.).

Anomites transversalis Wahlenberg, Act. Soc. Upsaliensis, III, 1821, p. 64.

Strophomena elegantula Hall, Geol. N. Y.; Rep. Fourth Dist., 1843, p. 72, fig. 1.

Strophomena transversalis Hall, Ibidem, 1843, p. 105, fig. 4.

Leptæna transversalis Hall, Pal. New York, II, 1852, p. 256, pl. 53, fig. 5.—Billings, Canadian Nat. Geol., I, 1856, p. 138, pl. 2, figs. 14, 15.—Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 46, figs. 34–36.

Plectambonites arca and tenera Shaler, Bull. Mus. Comp. Zool., 4, 1865, p. 64.

Leptæna transversalis var. elegantula Foerste, Proc. Boston Soc. Nat. Hist., XXIV, 1890, p. 294, pl. 6, fig. 6.

Plectambonites transversalis Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 298, pl. 15, figs. 34–36.—Foerste, Geol. Ohio, VII, 1895, p. 566, pl. 25, fig. 5; pl. 30, fig. 13; pl. 31, fig. 6.

Loc. Europe; New York; Osgood, Indiana; Wisconsin; Dundas and Hamilton, Ontario; Anticosti; Lake Temiscouata, New Brunswick.

Plectambonites transversalis alabamaensis (Foerste). Clinton (Sil.).

Leptæna transversalis var. alabamensis Foerste, Proc. Boston Soc. Nat. Hist., XXIV, 1890, p. 296, pl. 5, fig. 9.

Loc. Collinsville, Alabama.

Plectambonites transversalis prolongatus (Foerste). Clinton (Sil.).

Leptæna prolongata Foerste, Bull. Denison Univ., I, 1885, p. 79, pl. 13, fig. 5.

Leptæna transversalis var. prolongata Foerste, Proc. Boston Soc. Nat. Hist., XXIV, 1890, p. 297, pl. 5, fig. 13.

Loc. Dayton, Ohio; Wildwood Station, Georgia.

PLECTORTHIS Hall and Clarke. Genotype Orthis plicatella Hall.

Orthis (group of O. plicatella) Hall, Bull. Geol. Soc. America, I, 1889, p. 20.

Plectorthis Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 194, 221.—Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 435.—Hall and Clarke, Eleventh Ann. Rep. N. Y. State Geologist, 1894, p. 266.

Plectorthis æquivalvis (Hall). Lorraine (Ord.).

Orthis æquivalvis Hall (non Davidson, 1847), Pal. New York, I, 1847, p. 120, pl. 32, fig. 6.

Plectorthis æquivalvis (Hall)—Continued.

Plectorthis æquivalvis Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 194, 221.

Loc. Cincinnati, Ohio; Wisconsin (Whitfield).

Plectorthis (?) aurelia (Billings). Oriskany (Dev.).

Orthis aurelia Billings, Pal. Fossils, II, 1874, p. 34, pl. 3, fig. 3.

Plectorthis ? aurelia Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 221.

Loc. Indian Cove, Gaspé.

Plectorthis dichotoma Hall. Lorraine (Ord.).

Orthis dichotoma Hall, Pal. New York, I, 1847, p. 125, pl. 32, fig. 13.—Miller, American Pal. Fossils, 1877, p. 117.

Orthis fissicosta Meek (non Hall), Pal. Ohio, I, 1873, p. 106, pl. 8, fig. 6.—Miller, Cincinnati Quart. Jour. Sci., II, 1875, p. 30.

Orthis neglecta James, The Palæontologist, 4, 1879, p. 26.

Plectorthis dichotoma Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 221, pl. 5, fig. 21.

Loc. Cincinnati, Ohio.

Plectorthis ella Hall. Lorraine (Ord.).

Orthis ella Hall, Thirteenth Rep. N. Y. State Cab. Nat. Hist., 1861, p. 121.

Orthis ? ella Hall, Fifteenth Rep. Ibidem, 1862, pl. 2, figs. 6–8;—Twenty-fourth Rep. Ibidem, 1872, pl. 7, fig. 21.—Meek, Pal. Ohio, I, 1873, p. 105, pl. 8, fig. 9.—Hall and Whitfield, Ibidem, II, 1875, p. 76, pl. 1, fig. 20.—Miller, Cincinnati Quart. Jour. Sci., II, 1875, p. 32.

Plectorthis ? ella Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 221, pl. 5, figs. 22, 23.

Loc. Cincinnati, Ohio.

Plectorthis fissicosta Hall. Lorraine (Ord.).

Orthis fissicosta Hall, Pal. New York, I, 1847, p. 121, pl. 32, fig. 7.

Plectorthis fissicosta Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 194, 221.

Loc. Cincinnati, Ohio.

Plectorthis jamesi Hall. Lorraine (Ord.).

Orthis jamesi Hall, Fourteenth Rep. N. Y. State Cab. Nat. Hist., 1861, p. 89.—Miller, Cincinnati Quart. Jour. Sci., II, 1875, p. 33.—Hall and Whitfield, Pal. Ohio, II, 1875, p. 77, pl. 1, figs. 21, 22.

Plectorthis jamesi Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 194, 221.

Loc. Cincinnati, Ohio.

Plectorthis kankakiensis (McChesney). Lorraine (Ord.).

Orthis kankakensis McChesney, New Pal. Fossils, 1861, p. 77;—Trans. Chicago Acad. Sci., I, 1868, p. 29, pl. 9, fig. 3.

Plectorthis kankakensis Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 221, pl. 5, figs. 24, 25.

Loc. Wilmington, Illinois; Wisconsin (Whitfield).

Plectorthis plicatella Hall. Trenton-Lorraine (Ord.).

Orthis plicatella Hall, Pal. New York, I, 1847, p. 122, pl. 32, fig. 9.—Meek, Pal. Ohio, I, 1873, p. 108, pl. 8, fig. 7.—Miller, Cincinnati Quart. Jour. Sci., II, 1875, p. 30.

?Orthis plicatella Billings, Geol. Canada, 1863, p. 165, fig. 145.

Plectorthis plicatella Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 221, pl. 5, figs. 18–20.

Orthis (Plectorthis) plicatella Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 436, pl. 33, figs. 5–7.

Loc. Cincinnati, Ohio; Middleville and Watertown, New York; Burgin, Kentucky; Cannon Falls, Kenyon, etc., Minnesota; Wisconsin.

Plectorthis sectistriata (E. O. Ulrich). Lorraine (Ord.).

Orthis (?) sectostriata Ulrich, Jour. Cincinnati Soc. Nat. Hist., II, 1879, p. 15, pl. 7, fig. 11.

Plectorthis? sectostriata Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 221.

Loc. Cincinnati, Ohio.

Plectorthis triplicatella (Meek). Lorraine (Ord.).

Orthis triplicatella Meek, American Jour. Sci., IV, 1872, p. 281;—Pal. Ohio, I, 1873, p. 109, pl. 8, fig. 8.—Miller, Cincinnati Quart. Jour. Sci., II, 1875, p 31.

Plectorthis triplicatella Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 194, 221.

Loc. Cincinnati, Ohio.

Plectorthis whitfieldi (N. H. Winchell). Lorraine (Ord.).

Orthis whitfieldi N. H. Winchell, Ninth Ann. Rep. Geol. and Nat. Hist., Survey of Minnesota, 1881, p. 115.

Orthis pectinella Whitfield (partim, non Emmons non Hall), Geol. Wisconsin, IV, 1882, p. 259, pl. 12, fig. 8.

Plectorthis whitfieldi Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 221, pl. 5, fig. 26.

Orthis (Plectorthis) whitfieldi Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 437, pl. 33, figs. 8–13.

Loc. Spring Valley and Granger, Minnesota; Delafield, Wisconsin; Lattners, Iowa; Savanna, Illinois.

PLETHORHYNCHA Hall and C. Genotype Rhynchonella speciosa Hall.

Plethorhyncha Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 191;—Thirteenth Ann. Rep. N. Y. State Geologist, 1895, p. 827.

Obs. Proposed as a subgenus of Camarotœchia. It, however, does not seem to be worthy even of that rank. The species referred to Plethorhyncha are Camarotœchia barrandei Hall, C. pleiopleura (Conrad), and C. speciosa Hall.

Plicatula striatocostata Cox = Meekella striaticostata.

POLYTŒCHIA Hall and Clarke. Genotype Hemipronites apicalis Whitf.

Polytœchia Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 239, figs. 11, 12;—Eleventh Ann. Rep. N. Y. State Geologist, 1894, p. 275.

Polytœchia apicalis (Whitfield). Calciferous (Ord.).

Hemipronites apicalis Whitfield, Bull. American Mus. Nat. Hist., II, 1886, p. 300, pl. 24, figs. 1–5.

Polytœchia apicalis Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 239, fig. 11, 12, pl. 7A, figs. 26–30.

Loc. Fort Cassin, Vermont.

PORAMBONITES Pander. Genotype Porambonites intermedia Pander.

Porambonites Pander, Beitrage zur Geognosie des Russ. Reiches, 1830, p. 95, pl. 3, fig. 9.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, p. 225.

Obs. Not represented in America.

Porambonites obscurus Hall and Whitfield = Parastrophia obscurus.

Porambonites ottawaensis Billings = Rhynchotrema ottawaensis.

PROBOSCIDELLA Œhlert. Genotype Productus proboscideus de Vern.

Proboscidella Œhlert, Fischer's Manuel de Conchyliologie, 1887, p. 1277.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 333.

Proboscidella (?) clava (Norwood and Pratten). Upper Carboniferous.

Productus clavus Norwood and Pratten, Jour. Acad. Nat. Sci. Philadelphia, III, 1854, p. 10, pl. 1, fig. 4.

Proboscidella clava Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 33A.

Loc. Graysville, Illinois.

PRODUCTELLA Hall. Genotype Productus subaculeatus Murchison

Productella Hall, Twentieth Rep. N. Y. State Cab. Nat. Hist., 1867, p. 245;—Pal New York, IV, 1867, p. 153.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 69.—Hall and Clarke, Pal. New York, VIII Pt. I, 1892, p. 328;—Eleventh Ann. Rep. N. Y. State Geologist, 1894, p. 298.

Productella arctirostrata Hall. Chemung (Dev.)

Productus arctirostrata Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 177

Productella arctirostrata Pal. New York, IV, 1867, p. 182, pl. 26, figs. 16–23;—Second Ann. Rep. N. Y. State Geol., 1883, pl. 48, fig. 36.—Hall and Clarke Pal. New York, VIII, Pt. I, 1892, pl. 17, fig. 36.

Loc. Jasper and Cadiz, New York.

Productella arcuata Hall. Kinderhook (L. Carb.)

Productus arcuatus Hall, Geol. Survey of Iowa, I, Pt. II, 1858, p. 518, pl. 7, fig 4.—Herrick, Bull. Denison Univ., III, 1888, p. 31, pl. 3, fig. 18.—Keyes, Geol Survey Missouri, V, 1895, p. 40.

Productella arcuata Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 48, figs 31, 32.

Loc. Burlington, Iowa; Granville, Newark, etc., Ohio; Hannibal, Missouri.

Obs. See P. cooperensis.

Productella bialveata Hall. Chemung (Dev.)

Productella bialveata Hall, Pal. New York, IV, 1867, p. 183, pl. 26, figs. 24–28.

Loc. Meadville, Pennsylvania.

Productella boydi Hall. Chemung (Dev.)

Productus boydi Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 179 figs. 1–3.

Productella boydi Hall, Pal. New York, IV, 1867, p. 169, pl. 24, figs. 10–16;—Second Ann. Rep. N. Y. State Geol., 1883, pl. 48, fig. 24.—Hall and Clarke Pal. New York, VIII, Pt. I, 1892, pl. 17, fig. 24.

Loc. Phillipsburg, Elmira, etc., New York.

Productella concentrica (Hall). Kinderhook (L. Carb.)

Productus concentricus Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857 p. 180;—Geol. Survey Iowa, I, Pt. II, 1858, p. 517, pl. 7, fig. 3.—A. Winchell Proc. Acad. Nat. Sci. Philadelphia, 1862, p. 411;—Ibidem, 1865, p. 114;—Proc. American Philosophical Soc., XII, 1870, p. 249.—Herrick, Bull. Denison Univ., III, 1888, p. 33, pl. 6, fig. 16.

Loc. Burlington, Iowa; Port aux Barques, Michigan; Rockford, Indiana; Scioto ville, etc., Ohio.

Obs. Compare with Productella shumardana.

Productella costatula Hall. Chemung (Dev.)

Productella costatula Hall, Pal. New York, IV, 1867, p. 180, pl. 26, figs. 9, 15;—Second Ann. Rep. N. Y. State Geol., 1883, pl. 48, figs. 18–20, 35.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 17, figs. 18–20, 35.

Loc. Randolph Conewango, New Albion, etc., New York.

Productella costatula strigata Hall. Chemung (Dev.)

Productella costatula var. strigata Hall, Pal. New York, IV, 1867, p. 181.

Loc. Near Cadiz, New York.

Productella dumosa Hall. Hamilton (Dev.)

Productus dumosus Hall, Fourteenth Rep. N. Y. State Cab. Nat. Hist., 1861, p. 99

Productella dumosa Hall, Pal. New York, IV, 1867, p. 162, pl. 23, figs. 38–40;—Second Ann. Rep. N. Y. State Geol., 1883, pl. 48, fig. 21.—Hall and Clarke Pal. New York, VIII, Pt. I, 1892, pl. 17, fig. 21.

Loc. Delphi, Bellona, Moscow, Hamilton, etc., New York.

Productella (?) eriensis Nicholson. Corniferous (Dev.).

Productella eriensis Nicholson, Geol. Magazine London, n. ser., I, 1874, p. 118;—Pal. Prov. Ontario, 1874, p. 77, fig. 26.

Loc. Port Colborne and Hagersville, Ontario.

Obs. See Anoplia nucleata Hall.

Productella exanthemata Hall. Corniferous and Hamilton (Dev.).

Productus exanthematus Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 174.

Productella exanthemata Hall, Pal. New York, IV, 1867, p. 163, pl. 23, figs. 45, 46;—Second Ann. Rep. N. Y. State Geol., 1883, pl. 48, fig. 17.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 17, fig. 17.

Productus exanthematus ?? Meek and Worthen, Geol. Survey Illinois, III, 1868, p. 412, pl. 10, fig. 3.

Loc. Tinkers Falls and Seneca Lake, New York; Jackson and Union counties, Illinois.

Productella hallana Walcott. Upper Devonian.

Productus dissimilis Hall (non de Koninck, 1846), Geol. Survey Iowa, I, Pt. II, 1858, p. 497, pl. 3, fig. 7.—Meek, Trans. Chicago Acad. Sci., I, 1868, p. 91, pl. 13, fig. 3.

Productus ? Meek, Ibidem, 1868, p. 91, pl. 13, fig. 4.

Productus (Productella) hallanus Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 130, pl. 13, fig. 17.

Productus hallanus Tschernyschew, Mémoires du Comité Géologique de St. Pétersbourg, III, 1887, p. 114, pl. 14, fig. 27.—von Toll, Wissensch. Resultate d. Neusibirischen Exped., 1885 u. 1886, 1889, p. 25, pl. 2, fig. 19.

Productus hallianus Williams, Bull. Geol. Soc. America, I, 1890, pl. 12, figs. 8, 9.

Productella dissimilis Whiteaves, Cont. Canadian Pal., I, 1891, p. 216.

Productella hallana Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 17A, figs. 11, 12.

Loc. Rockford, Iowa; High Point, New York; Eureka district, Nevada; Athabasca River, Canada; Urals of Russia.

Productella hirsuta Hall. Chemung (Dev.).

Strophomena membranacea Vanuxem (non Productus membranaceus von Buch), Geol. N. Y.; Rep. Third Dist., 1842, p. 179, figs. 4, 5.

Productus hirsutus Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 175, figs. 1-3.

Productella hirsuta Hall, Pal. New York, IV, 1867, p. 166, pl. 24, figs. 17-29;—Second Ann. Rep. N. Y. State Geol., 1883, pl. 48, figs. 28, 39.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 17, figs. 28, 39, 45.

Loc. Phillipsburg and Rockville, New York; Covington, Pennsylvania.

Productella hirsuta rectispina Hall. Chemung (Dev.).

Productella hirsuta var. rectispina Hall, Pal. New York, IV, 1867, p. 168, pl. 24, figs. 30-37;—Second Ann. Rep. N. Y. State Geol., 1883, pl. 48, fig. 37.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 17, fig. 37.

Loc. Meadville, Pennsylvania.

Productella hirsutiformis (Walcott). Upper Devonian.

Productus hirsutiforme Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 133, pl. 2, fig. 10.

Loc. Eureka and White Pine districts, Nevada.

Productella hystricula Hall=Strophalosia hystricula.

Productella lachrymosa (Conrad). Chemung (Dev.).

Strophomena lachrymosa Conrad, Jour. Acad. Nat. Sci. Philadelphia, VIII, 1842, p. 256, pl. 14, fig. 9.

Productella lachrymosa (Conrad)—Continued.

Productus lachrymosus Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 177.
Productella lachrymosa Hall, Pal. New York, IV, 1867, p. 172, pl. 25, figs. 23–28.
Loc. Factoryville, Bath, Ellington, etc., New York.

Productella lachrymosa lima (Conrad). Chemung (Dev.).

Strophomena lima Conrad, Jour. Acad. Nat. Sci. Philadelphia, VIII, 1842, p. 256.
Productella lachrymosa var. lima Hall, Pal. New York, IV, 1867, p. 174, pl. 25, figs. 29–32;—Second Ann. Rep. N. Y. State Geol., 1883, pl. 48, figs. 22, 23.—Whiteaves, Cont. Canadian Pal., I, 1891, p. 217.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 17, figs. 22, 23.
Productus (Productella) lachrymosus var. limus Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 132, pl. 13, fig. 18.
Loc. Randolph, Ellington, etc., New York; Eureka district, Nevada; Mackenzie River, Canada.

Productella lachrymosa stigmata Hall. Chem. and Wav. (Dev. and L. Car.).

Productella lachrymosa var. stigmata Hall, Pal. New York, IV, 1867, p. 174, pl. 25, figs. 33–41.
?Productus ?Meek, Trans. Chicago Acad. Sci., I, 1868, p. 91, pl. 13, fig. 5.
Productus (Productella) lachrymosus var. stigmatus Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 132.—Herrick, Bull. Denison Univ., III, 1888, p. 34, pl. 3, fig. 28.
Loc. Olean, Conewango, and Randolph, New York; Licking County, Ohio; Eureka district, Nevada; Northwest Territory, Canada.

Productella mæcuruensis Rathbun. Middle Devonian.

Productella mæcuruensis Rathbun, Proc. Boston Soc. Nat. Hist., XX, 1879, p. 17.
Loc. Province of Para, Brazil.

Productella marquessi Rowley. Hamilton (Dev.).

Productella marquessi Rowley, American Geologist, XIII, 1894, p. 153, figs. 7, 8.
Loc. Callaway County, Missouri.

Productella minneapolis Sardeson=Trematis huronensis.

Productella murchisoniana (de Koninck). Hamilton (Dev.).

Productus murchisonianus de Koninck, Mém. de la Soc. Royale des Sciences de Liége, IV, 1846, p. 245, pl. 16, fig. 3.—Norwood and Pratten, Jour. Acad. Nat. Sci. Philadelphia, III, 1854, p. 21.
Loc. Devils Back Bone, Illinois.

Productella navicella Hall. Corniferous and Hamilton (Dev.).

Productus navicellus Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 172.
Productella navicella Hall, Pal. New York, IV, 1867, p. 156, pl. 23, figs. 1, 3, 9–11;—Second Ann. Rep. N. Y. State Geol., 1883, pl. 48, figs. 8, 9.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 17, figs. 8, 9;—Ibidem, VIII, Pt. II, 1895, pl. 84, fig. 19.
Productus (Productella) navicellus Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 131, pl. 13, fig. 9.
Loc. Schoharie County, Moscow, and Pavilion, New York; Eureka district, Nevada.

Productella onusta Hall. Chemung (Dev.).

Productella onusta Hall, Pal. New York, IV, 1867, p. 184, pl. 26, figs. 29–42;—Second Ann. Rep. N. Y. State Geologist, 1883, pl. 48, figs. 40–46.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 17, figs. 40–43, 46.
Loc. Conewango, Napoli, and New Albion, New York.

Productella papulata Hall. Hamilton (Dev.).

Productus papulatus Hall, Pal. New York, IV, 1867, p. 165, pl. 23, figs. 47, 48.

Productella papulata Hall, Ibidem, 1867, corrigenda.

Loc. Bellona, Yates County, New York.

Productella productoides (Murchison). Hamilton (Dev.).

Orthis productoides Murchison, Bull. Soc. Géol. de France, XI, 1840, p. 254, pl. 2, fig. 7.

Strophalosia productoides Whiteaves, Cont. Canadian Pal., I, 1889, p. 112, pl. 15, fig. 2;—Ibidem, I, 1891, p. 216.

Productella productoides Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 317.

Productella productoides var. membranacea Whiteaves, Cont. Canadian Pal., I, 1892, p. 282.

Loc. Europe; Athabasca River, Lake Manitoba, and Thedford, Canada.

Productella pyxidata Hall. Kinderhook (L. Carb.).

Productus pyxidatus Hall, Geol. Survey Iowa, I, Pt. II, 1858, p. 498, pl. 3, fig. 8.—Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 130.

Productella pyxidata Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 48, fig. 34.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 17, fig. 34; pl. 17A, fig. 14.—Keyes, Geol. Survey Missouri, V, 1895, p. 52.

Loc. Hamburg, Illinois; Louisiana, Missouri.

Obs. Compare with Productella shumardana.

Productella rarispina Hall. Chemung (Dev.).

Productus rarispinus Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 178.

Productella rarispina Hall Pal. New York, IV, 1867, p. 170, pl. 24, figs. 1-9;—Second Ann. Rep. N. Y. State Geol., 1883, pl. 48, fig. 33.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 17, fig. 33.

Loc. Phillipsburg, New York.

Productella semiglobosa Nettelroth. Corniferous (Dev.).

Productella semiglobosa Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 70, pl. 26, fig. 7.

Loc. Falls of Ohio.

Productella shumardana Hall. Kinderhook (L. Carb.).

Productus shumardianus Hall, Geol. Survey Iowa, I, Pt. II, 1858, p. 499, pl. 3, fig. 9; pl. 7, fig. 2.

Productella shumardiana Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 48, fig. 7.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 17, fig. 7.

Productus (Productella) shumardianus Herrick, Bull. Denison Univ., III, 1888, p. 32, pl. 6, fig. 16; pl. 7, fig. 18.

Loc. Clarksville, Missouri; Burlington, Iowa; Licking County, Ohio.

Obs. The identifications of this species from Devonian horizons are here referred to P. spinulicosta. P. shumardana is probably synonymous with P. pyxidata Hall.

Productella speciosa Hall. Portage, Chem., and Kinderh. (Dev.-L. Carb.).

Productus speciosus Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 176.

Producta speciosa A. Winchell, Proc. Acad. Nat. Sci. Philadelphia, 1863, p. 4.

Productella speciosa Hall, Pal. New York, IV, 1867, p. 175, pl. 25, figs. 1-11;—Second Ann. Rep. N. Y. State Geol., 1883, pl. 48, figs. 25, 26.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 17, figs. 25, 26.—Kindle, Bull. American Pal., 6, 1896, p. 35.

Productus (Productella) speciosus Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 133, pl. 13, fig. 8.

Productella speciosa Hall—Continued.

Productus (Productella) speciosus? Herrick, Bull. Denison Univ., III, 1888, p. 34.—
Loc. Leon, New Albion, and Ithaca, New York; Licking County, Ohio; Burlington, Iowa; Eureka district, Nevada.

Productella spinulicosta Hall. Corniferous to Hamilton (Dev.).—

Productus subaculeatus Norwood and Pratten (non Murchison), Jour. Acad. Nat. Sci. Philadelphia, III, 1854, p. 21.—Meek, King's U. S. Geol. Expl. 40th Parl. IV, 1877, p. 36, pl. 3, fig. 7.

Productus subaculeatus? Meek, Simpson's Rep. Expl. Great Basin Terr. Utah 1876, p. 345, pl. 1, fig. 3.

Productus spinulicostus Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 173.

Productella spinulicosta Hall, Pal. New York, IV, 1867, p. 160, pl. 23, figs. 6–8, 25–34;—Second Ann. Rep. N. Y. State Geol., 1883, pl. 48, figs. 3–6.—Whiteaves, Cont. Canadian Pal., I, 1891, p. 217, pl. 29, fig. 3; pl. 31, fig. 1.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 17, figs. 3–6.

Productella subaculeata Hall, Pal. New York, IV, 1867, p. 154, pl. 23, figs. 4, 5.—Whiteaves, Cont. Canadian Pal., I, 1892, p. 283.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 17, figs. 1, 2.

Productella subaculeata? Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 48, figs. 1, 2.

Productus (Productella) subaculeata Walcott, Mon. U. S. Geol. Survey, VIII, 1884, pp. 128, 214, pl. 7, fig. 2; pl. 13, figs. 19, 20.

Productus (Productella) subaculeatus var. cataractus Hall and Whitfield, Twenty-fourth Rep. N. Y. State Cab. Nat. Hist., 1872, p. 198;—Twenty-seventh Rep. Ibidem, 1875, pl. 9, figs. 9,10.

Productella subaculeata var. cataracta Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 69, pl. 17, figs. 5–9.—Whiteaves, Cont. Canadian Pal., I, 1891, p. 217.

Loc. New York; Ohio; Falls of Ohio; Illinois; Iowa; Wisconsin; Eureka district, Nevada; Utah; Mackenzie and Hay rivers, and Lake Manitoba, Canada.

Obs. Some authors are disposed to regard as synonyms of this species, besides the above, P. pyxidata, P. shumardana, and P. concentrica, and all of these forms are thought to be identical with P. subaculeata Murchison. For the present it is preferable to retain the name P. spinulicosta for these American Devonian forms. P. pyxidata, P. shumardana, and P. concentrica are here arranged as species, but will probably be shown to be synonymous with P. spinulicosta.

Productella striatula Hall. Chemung (Dev.).

Productella striatula Hall, Pal. New York, IV, 1867, p. 177, pl. 25, figs. 14–21;—Second Ann. Rep. N. Y. State Geol., 1883, pl. 48, figs. 27, 38.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 17, figs. 27, 38, 44.

Loc. New Albion, Conewango, and Cold Spring, New York.

Productella subaculeata of American authors = Productella spinulicosta.

Productella subaculeata cataracta Hall and Whitfield = Productella spinulicosta.

Productella subalata Hall. Middle Devonian.

Productus subalatus Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 174;—Geol. Survey Iowa, I, Pt. II, 1858, p. 500, pl. 3, fig. 10.

Productus callawayensis Swallow, Trans. St. Louis Acad. Sci., I, 1860, p. 640.

Productella subalata Hall, Pal. New York, IV, 1867, p. 165, pl. 23, fig. 49;—Second Ann. Rep. N. Y. State Geol., 1883, pl. 48, fig. 16.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 17, fig. 16.—Keyes, Geol. Survey Missouri, V, 1895, p. 52.

Loc. Rock Island, Illinois; Callaway County, Missouri; Spring Valley, Minnesota.

Productella truncata Hall=Strophalosia truncata.

Productella tullia Hall. Hamilton (Dev.).

Productella tullia Hall, Pal. New York, IV, 1867, p. 164, pl. 23, figs. 41–44.

Loc. Tully and Delphi Falls, New York.

PRODUCTUS Sowerby. Genotype Anomites productus Martin=Productus martini Sowerby=Productus semireticulatus (Martin).

Productus Sowerby, Mineral Conchology, I, 1814, p. 153.—de Koninck, Recher. Animaux Foss., Pt. I, 1847, p. 11.—Hall, Twentieth Rep. N. Y. State Cab. Nat. Hist., 1867, p. 245;—Pal. New York, IV, 1867, p. 146.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 321;—Eleventh Ann. Rep. N. Y. State Geologist, 1894, p. 297.

Productus æquicostatus Shumard=Productus cora.

Productus alternatus Norwood and Pratten. Keokuk (L. Carb.).

Productus alternatus Norwood and Pratten, Jour. Acad. Nat. Sci. Philadelphia, III, 1854, p. 20, pl. 2, fig. 1.—Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 49, fig. 14.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 18, fig. 14.

Productus vittatus Hall, Geol. Survey Iowa, I, Pt. II, 1858, p. 639.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 18, figs. 15–17.—Keyes, Geol. Survey Missouri, V, 1895, p. 43.

Productus vittata Hall, Second Ann. Rep. N. Y. State Geologist, 1883, pl. 49, figs. 15–17.

Loc. Rocky Run, Hancock County, Illinois; Keokuk, Iowa; Burlington group, Burlington, Iowa.

Obs. Compare with Productus fimbriatus and P. gradatus.

Productus altonensis Norwood and Pratten. St. Louis (L. Carb.).

Productus altonensis Norwood and Pratten, Jour. Acad. Nat. Sci. Philadelphia, III, 1854, p. 7, pl. 1, fig. 1.

Loc. Alton, Illinois.

Productus americanus Swallow=Productus cora.

Productus andii d'Orbigny=Orthis buchi.

Productus arctirostratus Hall=Productella arctirostrata.

Productus arcuatus Hall=Productella arcuata.

Productus asperus McChesney=Productus nebrascensis.

Productus auriculatus Swallow. ?Upper Carboniferous.

Productus auriculatus Swallow, Trans. St. Louis Acad. Sci., II, 1863, p. 92.

Productus (?auriculatus) Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 17A, fig. 24.

Loc. Formation and locality not given. ("Near Kansas City, Missouri," H. and C.)

Productus batesianus Derby. Upper Carboniferous.

Productus batesianus Derby, Bull. Cornell Univ., I, 1874, p. 54, pl. 1, figs. 2, 10–13, 15; pl. 2, fig. 14; pl. 6, figs. 4, 7, 9.

Loc. Bomjardim and Itaituba, Brazil.

Productus biseriatus Hall. St. Louis (L. Carb.).

Productus biseriatus Hall, Trans. Albany Institute, IV, 1858, p. 12.—Whitfield, Bull. American Mus. Nat. Hist., I, 1882, p. 46, pl. 6, figs. 8–12.—Hall, Twelfth Rep. State Geol. Indiana, 1883, p, 325, pl. 29, figs. 8–12.—Keyes, Geol. Survey Missouri, V, 1895, p. 43.

Loc. Alton, Illinois; Bloomington and Spergen Hill, Indiana; Crittenden County, Kentucky; Missouri.

Productus blairi Miller. Chouteau (L. Carb.).

Productus blairi Miller, Seventeenth Rep. State Geol. of Indiana, 1891, p. 79, pl. 13, figs. 16, 17.

Loc. Sedalia, Missouri.

Productus boliviaensis d'Orbigny. Upper Carboniferous.

Productus boliviensis d'Orbigny, Voyage dans l'Amérique Méridionale, Pal., 1842, p. 52, pl. 4, figs. 5–9.—de Koninck, Mém. de la Soc. Royale des Sci. Liége, IV, 1847, p. 177, pl. 8, fig. 2;—Recherches sur les Animaux Fossiles, Pt. I, 1847, p. 76, pl. 8, fig. 2.—Norwood and Pratten, Jour. Acad. Nat. Sci. Philadelphia, III, 1854, p. 11.

Productus cancrini Gabb, Jour. Acad. Nat. Sci. Philadelphia, 2d ser., VIII, 1881, p. 302.

Loc. Yarbichambi and Lake Titicaca, Bolivia; near Richmond, Missouri.

Productus boonensis Swallow. Upper Carboniferous.

Productus boonensis Swallow, Trans. St. Louis Acad. Sci., I, 1858, p. 217.

Loc. Near the mouth of Platte River; Kansas and Missouri.

Obs. Compare with Productus undiferus de Koninck.

Productus boonensis elevata Swallow. Upper Carboniferous.

Productus boonensis var. elevata Swallow, Trans. St. Louis Acad. Sci., I, 1858, p. 217.

Loc. Near the mouth of Platte River, Missouri.

Productus boydi Hall=Productella boydi.

Productus buchianus de Koninck. Upper Carboniferous.

Productus buchianus de Koninck, Recherches sur les Animaux Fossiles, Pt. I, 1847, p. 129, pl. 18, fig. 4.—Norwood and Pratten, Jour. Acad. Nat. Sci. Philadelphia, III, 1854, p. 20.

Loc. Belgium; Big Creek, Posey County, Indiana.

Productus burlingtonensis Hall. Burlington (L. Carb.).

Productus flemingi var. burlingtonensis Hall, Geol. Survey Iowa, I, Pt. II, 1858, p. 598, pl. 12, fig. 3.—Hall and Whitfield, King's U. S. Geol. Expl. 40th Parl., IV, 1877, p. 265, pl. 5, figs. 9–12.—Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 49, figs. 6–8.—Herrick, Bull. Denison Univ., III, 1888, p. 32, pl. 3, figs. 20 (?22).—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 18, figs. 6–8.

Productus burlingtonensis Keyes, Geol. Survey Missouri, V, 1895, p. 41.

Loc. Burlington, Iowa; Quincy, Illinois; Missouri; Oquirrh Mountains, Utah.

Obs. Compare with P. mesialis.

Productus calhounianus Geinitz (non Swallow)=Productus cora.

Productus calhounianus Swallow=Productus semireticulatus.

Productus calhounianus kansasensis Swallow=Productus semireticulatus kansasensis.

Productus callawayensis Swallow=Productella subalata.

Productus cancrini Geinitz=Productus pertenuis.

Productus cancrini Gabb=P. boliviaensis.

Productus capacii d'Orbigny. Upper Carboniferous.

Productus capacii d'Orbigny, Voyage dans l'Amérique Méridionale, Pal., 1842, p. 50, pl. 3, figs. 24–26.

Loc. Yarbichambi, Bolivia.

Productus carbonarius de Koninck. Carboniferous.

Productus carbonarius de Koninck, Description Animaux Fossiles, 1844, p. 181, pl. 12 bis, fig. 1.—Norwood and Pratten, Jour. Acad. Nat. Sci. Philadelphia, III, 1854, p. 11.

Loc. Belgium; Fountain Bluff, Illinois.

Productus cestriensis Worthen=Productus fasciculatus.

Productus chandlessii Derby. Upper Carboniferous.

Productus chandlessii Derby, Bull. Cornell Univ., I, 1874, p. 51, pl. 4, figs. 1–4, 7, 9–11, 13, 16; pl. 6, fig. 1;—Bull. Mus. Comp. Zool., III, 1876, p. 280.

Loc. Itaituba, Brazil; Yampopata, Bolivia.

Obs. Compare with Productus boliviaensis d'Orbigny.

Productus clarkianus Derby. Upper Carboniferous.

Productus clarkianus Derby, Bull. Cornell Univ., I, 1874, p. 59, pl. 6, fig. 6; pl. 9, figs. 12, 13.

Loc. Itaituba and Bomjardim, Brazil.

Productus clavus Norwood and Pratten=Proboscidella clava.

Productus concentricus Hall=Productella concentrica.

Productus confragosus Conrad. Upper Carboniferous.

Productus confragosus Conrad, Trans. Geol. Soc. Pennsylvania, I, 1835, p. 268, pl. 12, fig. 5.

Loc. Alleghany Mountains, Pennsylvania.

Obs. Not well established.

Productus cooperensis Swallow. Kinderhook (L. Carb.).

Productus cooperensis Swallow, Trans. St. Louis Acad. Sci., I, 1860, p. 640.—A. Winchell, Proc. Acad. Nat. Sci. Philadelphia, 1865, p. 115.

Productus cooperensis? A. Winchell, Proc. American Philosophical Soc., XII, 1870, p. 249.

Loc. Cooper County, Missouri; Burlington, Iowa; Sciotoville, Ohio.

Obs. Keyes regards this species as a synonym for Productella arcuata.

Productus cora d'Orbigny. Upper Carboniferous.

Productus cora d'Orbigny, Voyage dans l'Amérique Méridionale, Pal., 1842, p. 55, pl. 5, figs. 8–10.—de Koninck, Recherches sur les Animaux Fossiles, Pt. I, 1847, p. 50, pl. 4, fig. 4; pl. 5, fig. 2.—Owen, Geol. Rep. Wisconsin, Iowa, and Minnesota, 1852, pp. 103, 136, pl. 5, fig. 1.—Norwood and Pratten, Jour. Acad. Nat. Sci. Philadelphia, III, 1854, p. 6.—Marcou, Geol. North America, 1858, p. 45, pl. 6, fig. 4.—Davidson, Quart. Jour. Geol. Soc. London, XIX, 1863, p. 174, pl. 9, figs. 22, 23.—Geinitz, Carbon und Dyas in Nebraska, 1866, p. 50.—Derby, Bull. Mus. Comp. Zool., III, 1876, p. 281.—Dawson, Acadian Geology, 3d ed., 1878, p. 297, fig. 98.—Waagen, Palæontologica Indica, Ser. XIII, I, 1884, p. 677.—White, Thirteenth Rep. State Geol. Indiana, 1884, p. 126, pl. 26, figs. 1–3.—Herrick, Bull. Denison Univ., II, 1887, p. 47, pl. 2, fig. 26.—Keyes, Proc. Acad. Nat. Sci. Philadelphia, 1888, p. 227;—Geol. Survey Missouri, V, 1895, p. 47, pl. 37, fig. 2.

Productus cfr. cora Toula, Sitzb. der k. k. Akad. der Wissensch. zu Wien, LIX, 1869, p. 9.

Productus cora? Derby, Bull. Cornell Univ., I, 1874, p. 49, pl. 2, fig. 17; pl. 6, fig. 17.

Productus lyelli de Verneuil, Lyell's Travels in North America, II, 1845, p. 221.—Dawson, Acadian Geology, 1855, p. 219, fig. g.

Productus sp. Christy, Letters on Geology, 1848, pl. 5, fig. 1.

Productus cora d'Orbigny—Continued.

Productus semireticulatus Hall, Stansbury's Expl. and Survey Valley Great Salt Lake, Utah, 1852, p. 411, pl. 3, figs. 3, 5.

Productus prattenianus Norwood, Jour. Acad. Nat. Sci. Philadelphia, III, 1854, p. 17, fig. 10.—Meek, Final Rep. U. S. Geol. Survey of Nebraska, 1872, p. 163, pl. 2, fig. 5; pl. 5, fig. 13; pl. 8, fig. 10.—White, Wheeler's Expl. and Survey west 100th Meridian, IV, 1875, p. 113, pl. 7, fig. 1.—Meek, King's U. S. Geol. Expl. 40th Parl., IV, 1877, p. 72, pl. 7, fig. 7.

Productus æquicostatus Shumard, Geol. Rep. Missouri, I, 1855, p. 201, Pl. C, fig. 10.—Schiel, Pacific R. R. Reports, II, 1855, p. 108, pl. 2, figs. 4, 5.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, figs. 22, 23.

Productus pileiformis McChesney, New Pal. Fossils, 1860, p. 40.—Whitfield, Annals N. Y. Acad. Sci., V, 1891, p. 582, pl. 13, figs. 13, 14;—Geol. Ohio, VII, 1895, p. 470, pl. 9, figs. 13, 14.

Productus americanus Swallow, Trans. St. Louis Acad. Sci., II, 1863, p. 91.

Productus flemingi Geinitz (non de Koninck), Carbon und Dyas in Nebraska, 1866, p. 52, pl. 4, figs. 1–4.

Productus koninckianus Geinitz (non de Verneuil), Ibidem, 1866, p. 53, pl. 4, fig. 5.

Productus calhounianus Geinitz (non Swallow), Ibidem, 1866.

Loc. Throughout the Upper Carboniferous of North America; Itaituba and Barreirinha, Brazil; Yampopata, Cochabamba, and Lake Titicaca, Bolivia; Kashmere.

Obs. See Productus nodosus and P. hildrethianus.

Productus cora mogoyoni Marcou. Upper Carboniferous.

Productus cora var. mogoyoni Marcou, Geol. North America, 1858, p. 45, pl. 6, fig. 5.

Loc. Sierra de Mogoyn, or Sierra Blanca, near the extinct volcano San Francisco, Arizona.

Productus coriformis Swallow. St. Louis (L. Carb.).

Productus coræformis Swallow, Trans. St. Louis Acad. Sci., II, 1863, p. 94.

Loc. Cooper County, Missouri.

Obs. Keyes regards this species as a synonym for P. lævicostus.

Productus costatoides Swallow. Upper Carboniferous.

Productus costatoides Swallow, Trans. St. Louis Acad. Sci., I, 1858, p. 217.—Newberry, Ives's Rep. Colorado River of the West, 1861, p. 123.

Loc. Kansas; banks of Colorado River.

Obs. Keyes regards this species as identical with P. longispinus.

Productus costatus (Sowerby ?) de Koninck. Upper Carboniferous.

?Productus costatus Sowerby, Mineral Conchology, VI, 1827, p. 115, pl. 560, fig. 1.

Productus costatus de Koninck, Recherches sur les Animaux Fossiles, Pt. I, 1847, p. 92, pl. 8, fig. 3; pl. 10, fig. 3; pl. 18, fig. 3.—Norwood and Pratten, Jour. Acad. Nat. Sci. Philadelphia, III, 1854, p. 11.—Marcou, Geol. North America, 1858, p. 43, pl. 5, fig. 5.—Geinitz, Carbon und Dyas in Nebraska, 1866, p. 51.—Meek, Final Rep. U. S. Geol. Survey Nebraska, 1872, p. 159, pl. 6, fig. 6.—White, Wheeler's Expl. and Survey West 100th Meridian, IV, 1875, p. 109, pl. 8, fig. 2;—Second Ann. Rep. Indiana Bureau of Statistics and Geol., 1880, p. 516, pl. 8, figs. 7, 8;—Tenth Rep. State Geol. Indiana, 1881, p. 148, pl. 8, figs. 7, 8.—Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 50, figs. 8–13.—White, Thirteenth Rep. State Geol. Indiana, 1884, p. 124, pl. 24, figs. 4–6; pl. 25, figs. 3–5.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 19, figs. 8–13.—Keyes, Geol. Survey Missouri, V, 1895, p. 51, pl. 36, fig. 1.

Productus costatus (Sowerby?) de Koninck—Continued.

Productus costatus? Derby, Bull. Mus. Comp. Zool., III, 1876, p. 280.

Productus costatus var. Hall, Geol. Survey Iowa, I, Pt. II, 1858, p. 712, pl. 28, figs. 3, 4.—Meek, King's U. S. Geol. Expl. 40th, Parl., IV, 1877, pl. 7, fig. 4.

Productus portlockianus Norwood and Pratten, Jour. Acad. Nat. Sci. Philadelphia, III, 1854, p. 15, pl. 1, fig. 9.

Productus sp. Rogers, Geol. Pennsylvania, II, Pt. II, 1858, p. 833, fig. 687.

Productus viminalis White, Proc. Boston Soc. Nat. Hist., IX, 1862, p. 29.

Loc. Europe; throughout the Upper Carboniferous of North America; Yampopata, Bolivia.

Obs. Sowerby's species is of uncertain value. The above synonomy is based upon P. costatus as redefined and illustrated by de Koninck.

Productus curtirostratus A. Winchell. Kinderhook (L. Carb.).

Productus curtirostra A. Winchell, Proc. Acad. Nat. Sci. Philadelphia, 1865, p. 114.

Productus curtirostratus Miller, N. American Geol. Pal., 1889, p. 364.

Loc. Burlington, Iowa.

Productus delawarei Marcou. Carboniferous.

Productus delawarii Marcou, Geol. North America, 1858, p. 45, pl. 5, fig. 3.

Loc. Foot of Delaware Mountain, Texas.

Obs. Compare with Productus cora d'Orbigny.

Productus depressus Swallow. Keokuk (L. Carb.).

Productus depressus Swallow, Trans. St. Louis Acad. Sci., II, 1863, p. 93.

Loc. Fenton, St. Louis County, Missouri.

Productus dissimilis Hall (non de Koninck)=Productella hallana.

Productus dolorosus A. Winchell. Waverly (L. Carb.).

Productus dolorosus A. Winchell, Proc. Acad. Nat. Sci. Philadelphia, 1865, p. 114.

Loc. Weymouth, Medina County, Ohio.

Productus dumosus Hall=Productella dumosa.

Productus duplicostatus A. Winchell. Waverly (L. Carb.).

Productus duplicostatus A. Winchell, Proc. Acad. Nat. Sci. Philadelphia, 1865, p. 113.—Herrick, Bull. Denison Univ., IV, 1888, p. 21, pl. 11, figs. 26, 29.

Loc. Knox and Licking counties, Ohio; Battlecreek, Michigan.

Productus elegans Norwood and Pratten (non McCoy)=Productus fasciculatus.

Productus exanthematus Hall=Productella exanthemata.

Productus fasciculatus McChesney. Kaskaskia (L. Carb.).

Productus elegans Norwood and Pratten (non McCoy), Jour. Acad. Nat. Sci. Philadelphia, III, 1854, p. 13, fig. 7.—Whitfield, Annals N. Y. Acad. Sci., V, 1891, p. 581, pl. 13, figs. 15–16;—Geol. Ohio, VII, 1895, p. 469, pl. 9, figs. 15, 16.

Productus fasciculatus McChesney, New Pal. Fossils, 1860, p. 38.

Productus cestriencis Worthen, Trans. St. Louis Acad. Sci., I, 1860, p. 570.—Keyes, Geol. Survey Missouri, V, 1895, p. 44.

?Productus elegans Hall and Whitfield, King's U. S. Geol. Expl. 40th Parl., IV, 1877, p. 268, pl. 5, figs. 3, 4.

Loc. Chester and Kaskaskia, Illinois; Leavenworth and Washington County, Indiana; Missouri; Monongalia County, West Virginia; Caldwell County, Kentucky; Newtonville, Ohio; ?Oquirrh Mountains, Utah.

Productus fentonensis Swallow. Keokuk (L. Carb.).

Productus fentonensis Swallow, Trans. St. Louis Acad. Sci., II, 1863, p. 93.

Loc. Fenton, St. Louis County, Missouri.

Obs. Keyes says this is a synonym for P. magnus.

Productus fimbriatus Sowerby. ?St. Louis. ?Upper Carboniferous.

Productus fimbriatus Sowerby, Mineral Conchology, V, 1824, p. 85, pl. 459, fig. 1.—Norwood and Pratten, Jour. Acad. Nat. Sci. Philadelphia, III, 1854, p. 19.—Etheridge, Quart. Jour. Geol. Soc. London, XXXIV, 1878, p. 630.

Loc. Alton, Illinois; Posey County, Indiana; Feilden Isthmus, lat. 82° 43′.

Obs. Compare with Productus alternatus Norwood and Pratten.

Productus flemingi Geinitz (non de Koninck)=Productus cora.

Productus flemingi Marcou, and Roemer=Productus longispina.

Productus flemingi burlingtonensis Hall=Productus burlingtonensis.

Productus flexistria McCoy. Kaskaskia (L. Carb.).

Productus flexistria McCoy, Synopsis Carb. Fossils of Ireland, 1844, p. 109, pl. 20, fig. 16.—Norwood and Pratten, Jour. Acad. Nat. Sci. Philadelphia, III, 1854, p. 6.

Loc. Chester, Kaskaskia, and Fountain Bluff, Illinois; Stephensport, Kentucky.

Productus giganteus (Martin). Upper Carboniferous.

Anomites giganteus Martin, Petrefacta Derbiensia, 1809, p. 6, pl. 15, fig. 1.

Productus giganteus White, Proc. U. S. Nat. Mus., III, 1880, p. 46;—Twelfth Ann. Rep. U. S. Geol. Survey of the Terr., 1883, p. 132, pl. 36, fig. 1.

Loc. Europe; McCloud River, Shasta County, California.

Productus gracilis A. Winchell. Waverly (L. Carb.).

Productus gracilis A. Winchell, Proc. Acad. Nat. Sci. Philadelphia, 1865, p. 112.—Herrick, Bull. Denison Univ., III, 1888, p. 34, pl. 7, fig. 2.

Productus gracilis? A. Winchell, Proc. American Philosophical Soc., XII, 1870, p. 250.

Loc. Near Cuyahoga Falls, Sciotoville, and Granville, Ohio.

Productus gradatus Swallow. Keokuk (L. Carb.).

Productus gradatus Swallow, Trans. St. Louis Acad. Sci., II, 1863, p. 93.

Loc. Keokuk, Iowa; Lewis and St. Louis counties, Missouri.

Obs. Keyes regards this species as identical with P. vittatus=P. alternatus.

Productus granulosus Phillips. Keokuk (L. Carb.).

Productus granulosus Phillips, Geol. Yorkshire, II, 1836, p. 216, pl. 8, fig. 15.—Norwood and Pratten, Jour. Acad. Nat. Sci. Philadelphia, III, 1854, p. 21.

Loc. Nauvoo, Illinois.

Productus hepar Morton. Upper Carboniferous.

Productus hepar Morton, American Jour. Sci., XXIX, 1836, p. 153, pl. 26, fig. 39.

Loc. Junior Furnace, Scioto County, Ohio.

Obs. Not recognizable.

Productus hildrethanus Norwood and Pratten. Upper Carboniferous.

Productus hildrethianus Norwood and Pratten, Jour. Acad. Nat. Sci. Philadelphia, III, 1854, p. 18, pl. 1, fig. 11.

Loc. Charboniere, Missouri.

Obs. Keyes regards this form as a synonym for P. cora.

Productus hirsutiforme Walcott=Productella hirsutiforme.

Productus hirsutus Hall=Productella hirsuta.

Productus horridus (non Sowerby)=Productus longispina.

Productus humboldti d'Orbigny. Upper Carboniferous.

Productus humboldti d'Orbigny, Voyage dans l'Amérique Méridionale, Pal., 1842, p. 54, pl. 5, figs. 4–7.—de Koninck, Recherches sur les Animaux Fossiles, Pt. I, 1847, p. 114, pl. 12, fig. 2.—Toula, Sitzb. der k. k. Akad. der Wissensch., XVIII, 1873, p. 16, pl. 2, fig. 3.—Waagen, Palæontologica Indica, Ser. XIII, I, 1884, p. 695, pl. 76, figs. 1–3.

Productus humboldti ? de Keyserling, Reise in das Petschora-Land, 1846, p. 201, pl. 4, fig. 3.

Loc. Yarbichambi, Bolivia; south end of Spitzbergen; Nishnei-Irginsk, Russia; India; Kashmere.

Productus inca d'Orbigny=Productus semireticulatus.

Producta incurvata Shepard=Strophomena incurvata.

Productus indianaensis Hall. St. Louis (L. Carb.).

Productus indianensis Hall, Trans. Albany Institute, IV, 1858, p. 13.—Whitfield, Bull. American Mus. Nat. Hist., I, 1882, p. 47, pl. 6, figs. 6, 7.—Hall, Twelfth Rep. State Geol. Indiana, 1883, p. 326, pl. 29, figs. 6, 7.

Loc. Spergen Hill, Indiana.

Productus inflatus McChesney. Upper Carboniferous.

Productus inflatus McChesney, New Pal. Fossils, 1860, p. 40;—Trans. Chicago Acad. Sci., I, 1868, p. 27, pl. 6, fig. 1.

Loc. Leavenworth, Indiana.

Productus ivesi Newberry. Upper Carboniferous.

Productus ivesi Newberry, Ives's Rep. Colorado River of the West, 1861, p. 122, pl. 2, figs. 1–8.

Loc. Colorado River near mouth of Diamond River.

Productus koninckianus Geinitz (non de Verneuil)=Productus cora.

Productus lævicosta White. Kinderhook (L. Carb.).

Productus lævicostus White, Jour. Boston Soc. Nat. Hist., VII, 1860, p. 230.—Keyes, Geol. Survey Missouri, V, 1895, p. 41, pl. 38, fig. 1.

Productus lævicostus ? Hall and Whitfield, King's U. S. Geol. Expl. 40th Parl., IV, 1877, p. 266, pl. 5, figs. 7, 8.

Loc. Burlington, Iowa; Louisiana, Missouri; Oquirrh Mountains, Utah.

Obs. Compare with P. coræformis.

Productus lasallensis Worthen. Upper Carboniferous.

Productus lasallensis Worthen, Geol. Survey Illinois, V, 1873, p. 569, pl. 25, fig. 9.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 17A, fig. 13.

Loc. Lasalle, Illinois.

Productus latissimus Sowerby. Carboniferous.

Productus latissimus Sowerby, Mineral Conchology, 1822, pl. 330.—Meek, Bull. U. S. Geol. Survey of the Terr., II, 1876, p. 354, pl. 1, fig. 1.

Loc. Europe; Vancouver Island.

Productus leuchtenbergensis de Koninck. Carboniferous.

Productus leuchtenbergensis de Koninck, Recherches sur les Animaux Fossiles, Pt. I, 1847, p. 121, pl. 14, fig. 3.—Norwood and Pratten, Jour. Acad. Nat. Sci. Philadelphia, III, 1854, p. 19.

Loc. Europe; Masons Landing, Jersey County, Illinois.

Productus longispina Sowerby? Upper Carboniferous.

? Productus longispinus Sowerby, Mineral Conchology, I, 1814, p. 154, pl. 68, fig. 1.

Productus longispinus Salter, Quart. Jour. Geol. Soc. London, XVII, 1861, p. 64, pl. 4, fig. 2.—Meek, Final Rep. U. S. Geol. Survey Nebraska, 1872, p. 161, pl.

Productus longispina Sowerby?—Continued.

6, fig. 7; pl. 8, fig. 6.—Meek and Worthen, Geol. Survey Illinois, V, 1873, p. 569, pl. 25, fig. 10.—White, Wheeler's Expl. and Survey west 100th Meridian, IV, 1875, p. 118, pl. 8, fig. 5.—Meek, King's U. S. Geol. Expl. 40th Parl., IV, 1877, p. 78, pl. 8, fig. 4.—Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 50, figs. 1–4.—White, Thirteenth Rep. State Geol. Indiana, 1884, p. 127, pl. 24, figs. 10, 11.—Herrick, Bull. Denison Univ., II, 1887, p. 48, pl. 2, figs. 25, 27, 28.—Keyes, Geol. Survey Missouri, V, 1895, p. 45, fig. 4.

Productus flemingi Roemer (non de Koninck), Kreidebildung Texas, 1852, p. 89, pl. 11, fig. 8.—Marcou, Geol. North America, 1858, p. 47, pl. 6, fig. 7.

Productus splendens Norwood and Pratten, Jour. Acad. Nat. Sci. Philadelphia, III, 1854, p. 11, pl. 1, fig. 5.—Schiel, Pacific R. R. Reports, II, 1855, p. 108, pl. 1, fig. 3.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 19, figs. 1–4.

Productus splendens (?) Meek and Hayden, Proc. Acad. Nat. Sci. Philadelphia, III, 1859, p. 25.—Newberry, Ives's Rep. Colorado River of the West, 1861, p. 124.

Productus wabashensis Norwood and Pratten, Jour. Acad. Nat. Sci. Philadelphia, III, 1854, p. 13, pl. 1, fig. 6.

Productus horridus Geinitz, Carbon und Dyas in Nebraska, 1866, p. 55, pl. 4, fig. 7.

Productus orbignyanus Geinitz (?non de Koninck), Ibidem, 1866, p. 56, pl. 4, figs. 8–11.

Productus (Marginifera) splendens Smith, Proc. American Phil. Soc., XXXV, 1897, p. 29.

Loc. Throughout the Upper Carboniferous of the United States; Bolivia.

Obs. Since considerable uncertainty exists as to Sowerby's species, it may be better to adopt P. orbignyanus de Koninck for the above synonymy. P. costatoides is also regarded by Keyes as a synonym for P. longispinus.

Productus longus Meek. Carboniferous.

Productus sp. undet. Meek, King's U. S. Geol. Expl. 40th Parl., IV, 1877, p. 67.

Productus longus Meek, Ibidem, 1877, end of description.

Productus ivesi? Meek, Ibidem, 1877, pl. 7, fig. 6.

Loc. White Pine district, Nevada.

Productus lyelli de Verneuil=Productus cora.

Productus magnicostatus Swallow. Upper Carboniferous.

Productus magnicostatus Swallow, Trans. St. Louis. Acad. Sci., I, 1860, p. 641.

Loc. Johnson County, Missouri.

Obs. Keyes regards this species as a synonym for P. semireticulatus.

Productus magnus Meek and Worthen. Keokuk (L. Carb.).

Productus magnus Meek and Worthen, Proc. Acad. Nat. Sci. Philadelphia, 1861, p. 142;—Geol. Survey Illinois, III, 1868, p. 528, pl. 20, fig. 7.—Keyes, Geol. Survey Missouri, V, 1895, p. 41.

Loc. Monroe County, Illinois; St. Genevieve County, Missouri.

Obs. Compare with P. fentonensis.

Productus margaritaceus Phillips. Upper Carboniferous.

Producta margaritacea Phillips, Geol. Yorkshire, II, 1836, p. 215, pl. 8, fig. 8.

Productus margaritaceus Norwood and Pratten, Jour. Acad. Nat. Sci. Philadelphia, III, 1854, p. 6.

Loc. Near Richmond, Missouri.

Productus marginicinctus Prout. St. Louis (L. Carb.).

Productus marginicinctus Prout, Trans. St. Louis Acad. Sci., I, 1857, p. 43, pl. 2, figs. 1–16.—Hall, Geol. Survey Iowa, I, Pt. II, 1858, p. 674, pl. 24, fig. 3.—Keyes, Geol. Survey Missouri, V, 1895, p. 43.

Loc. St. Louis, Missouri; Milan, Illinois.

Obs. See Productus wortheni Hall.

Productus martini Sowerby=Productus semireticulatus.

Productus mesialis Hall. Keokuk (L. Carb.).

Productus mesialis Hall, Geol. Survey Iowa, I, Pt. II, 1858, p. 636, pl. 19, fig. 2;—Second Ann. Rep. N. Y. State Geol., 1883, pl. 49, figs. 9, 10.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 18, figs. 9, 10.

Loc. Keokuk, Iowa; Nauvoo, Illinois.

Obs. Keyes regards this species as identical with P. burlingtonensis.

Productus mesolobus Phillips. Carboniferous.

Productus mesoloba Phillips, Geol. Yorkshire, II, 1836, p. 215, pl. 7, figs. 12, 13.

Productus mesolobus Etheridge, Quart. Jour. Geol. Soc. London, XXXIV, 1878, p. 630.

Loc. Europe; Feilden Isthmus, lat. 82° 43′.

Productus mexicoanus Shumard. Upper Carboniferous.

Productus mexicanus Shumard, Trans. St. Louis Acad. Sci., I, 1858, p. 291.—Kayser, Richthofens China, IV, 1883, p. 182, pl. 28, fig. 7.

Productus mexicanus? White, Wheeler's Expl. and Survey west 100th Meridian, IV, 1875, p. 120, pl. 8, fig. 6.

Loc. Guadalupe Mountains, New Mexico; Lincoln County, Nevada; Lo-Ping, China.

Productus morbillianus A. Winchell. Burlington (L. Carb.).

Producta morbilliana A. Winchell, Proc. Acad. Nat. Sci. Philadelphia, 1865, p. 113.

Loc. Burlington, Iowa; Sciotoville, Ohio.

Productus multistriatus Meek. Carboniferous.

Productus multistriata Meek, Proc. Acad. Nat. Sci. Philadelphia, 1860, p. 309.

Productus multistriatus Meek, Simpson's Rep. Expl. Great Basin Terr. Utah, 1876, p. 350, pl. 1, fig. 8;—King's U. S. Geol. Expl. 40th Parl., IV, 1877, p. 76, pl. 8, fig. 3.

Loc. Utah and Nevada.

Productus muricatus Norwood and Pratten. Upper Carboniferous.

Productus muricatus Norwood and Pratten (non Phillips), Jour. Acad. Nat. Sci. Philadelphia, III, 1854, p. 14, pl. 1, fig. 8.—White, Wheeler's Expl. and Survey west 100th Meridian, IV, 1875, p. 120, pl. 8, fig. 4.—Herrick, Bull. Denison Univ., II, 1887, p. 49.—Keyes, Proc. Acad. Nat. Sci. Philadelphia, 1888, p. 228.

Loc. Pike County, Illinois; near Richmond, Missouri; Des Moines Valley, Iowa; Flint Ridge, Ohio; Lake County, Colorado; northern New Mexico.

Obs. Since Phillips's P. muricatus is regarded as a synonym for P. costatus, there is no need for another specific name for Norwood and Pratten species.

Productus nanus Meek and Worthen. Upper Carboniferous.

Productus nanus Meek and Worthen, Proc. Acad. Nat. Sci. Philadelphia, 1860, p. 450;—Geol. Survey Illinois, II, 1866, p. 320, pl. 26, fig. 4.—Keyes, Proc. Acad. Nat. Sci. Philadelphia, 1888, p. 227.

Loc. Jefferson County, Iowa; northern New Mexico (White).

Productus navicella Hall=Productella navicella.

Productus nebraskaensis Owen. Upper Carboniferous.

Productus nebrascensis Owen, Geol. Rep. Wisconsin, Iowa, and Minnesota, 1852, p. 584, pl. 5, fig. 3.—McChesney, Trans. Chicago Acad. Sci., I, 1868, p. 24, pl. 1, fig. 7.—Meek, Final Rep. U. S. Geol. Survey Nebraska, 1872, p. 165, pl. 2, fig. 2; pl. 4, fig. 6; pl. 5, fig. 11.—Meek and Worthen, Geol. Survey Illinois, V, 1873, p. 569, pl. 25, fig. 8.—White, Wheeler's Expl. and Survey west 100th Meridian, IV, 1875, p. 116, pl. 8, fig. 3.—Meek, King's U. S. Geol. Expl. 40th Parl., IV, 1877, p. 65.—White, Thirteenth Rep. State Geol. Indiana, 1884, p. 122, *pl. 24, figs. 7-9.*—Herrick, Bull. Denison Univ., II, 1887, p. 49, pl. 2,

Productus nebraskaensis Owen—Continued.

fig. 30.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 19, figs. 5–7.—Keyes, Geol. Survey Missouri, V, 1895, p. 48, pl. 37, fig. 3.

Productus nebrascensis? Herrick, Bull. Denison Univ., III, 1888, p. 31, pl. 1, fig. 24; pl. 3, fig. 23.

Productus rogersi Norwood and Pratten, Jour. Acad. Nat. Sci. Philadelphia, 2d ser., III, 1854, p. 9, pl. 1, fig. 3.—Hall, Pacific R. R. Reports, III, 1856, p. 104, pl. 2, figs. 14, 15.—Meek and Hayden, Proc. Acad. Nat. Sci. Philadelphia, 1859, p. 26.—Newberry, Ives's Rep. Colorado River of the West, 1861, p. 121.—Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 50, figs. 17, 18.

Productus asperus McChesney, New Pal. Fossils, 1860, p. 34.—Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 50, figs. 5–7.

Productus wilberanus McChesney, New Pal. Fossils, 1860, p. 36;—Trans. Chicago Acad. Sci., I, 1868, p. 26, pl. 1, fig. 8.

Strophalosia horrescens Geinitz (non Murchison Vern. and Keyser.), Carbon und Dyas in Nebraska, 1866, p. 49.

Loc. Bellevue, Missouri; Illinois; Indiana; Ohio; Nebraska; New Mexico; Nevada; Arizona; Utah.

Obs. Compare with P. norwoodi.

Productus nevadaensis Meek. Upper Carboniferous.

Productus nevadensis Meek, King's U. S. Geol. Expl. 40th Parl., IV, 1877, p. 64, pl. 8, fig. 2.

Loc. White Pine district, Nevada.

Obs. Compare with Productus punctatus (Martin).

Productus newberryi Hall. Waverly (L. Carb.).

Productus newberryi Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 180.—A. Winchell, Proc. Acad. Nat. Sci. Philadelphia, 1865, p. 115.—Herrick, Bull. Denison Univ., IV, 1888, p. 20, pl. 10, figs. 24, 25.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 18, figs. 1–3.

Productella newberryi Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 49, figs. 1–3.

Loc. Medina County and Newark, Ohio.

Productus newberryi annosus Herrick. Waverly (L. Carb.).

Productus newberryi var. annosus Herrick, Bull. Denison Univ., IV, 1888, p. 20, pl. 3, fig. 17;—Geol. Ohio, VII, 1895, pl. 23, fig. 13.

Loc. Alexandria, Ohio.

Productus nodicostatus Herrick. Waverly (L. Carb.).

Productus nodocostatus Herrick, Bull. Denison Univ., IV, 1888, p. 23.

Loc. Rushville, Ohio.

Productus nodosus Newberry. Upper Carboniferous.

Productus nodosus Newberry, Ives's Rep. Colorado River of the West, 1861, p. 124, pl. 1, fig. 7;—Macombes' Rep. Expl. Exped. Santa Fe to the Great Colorado River of the West, 1876, p. 140, pl. 3, fig. 3.

Loc. Santa Fe, New Mexico.

Obs. Probably a synonym for Productus cora d'Orbigny.

Productus norwoodi Swallow. Upper Carboniferous.

Productus (Strophalosia?) norwoodii Swallow, Trans. St. Louis Acad. Sci., I, 1858, p. 182.

Productus norwoodi Meek and Hayden, Proc. Acad. Nat. Sci. Philadelphia, 1859, p. 35.

Loc. Cottonwood Valley, Kansas.

Obs. Compare with Productus pustulosus Phillips and P. scabriculus (Martin). Regarded by Keyes as a synonym for P. nebraskaensis.

Productus occidentalis Newberry. Upper Carboniferous.

Productus occidentalis Newberry, Ives's Rep. Colorado River of the West, 1861, p. 122, pl. 2, figs. 9, 10.

Loc. Banks of Cascade River near the junction of Great and Little Colorado rivers.

Productus orbignyanus Geinitz (non de Koninck)=Productus longispinus.

Productus ovatus Hall. St. Louis (L. Carb.).

Productus ovatus Hall, Geol. Survey Iowa, I, Pt. II, 1858, p. 674, pl. 24, fig. 1;—Second Ann. Rep. N. Y. State Geol., 1883, pl. 49, fig. 19.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 18, fig. 19.

Loc. Ottumwa and Keosauqua, Iowa.

Productus papilio Gabb. Upper Carboniferous.

Productus papilio Gabb, Jour. Acad. Nat. Sci. Philadelphia, 2d ser., VIII, 1881, p. 302, pl. 42, fig. 12.

Loc. Lake Titicaca, Bolivia.

Productus papulatus Hall=Productella papulata.

Productus parvulus A. Winchell. Kinderhook (L. Carb.).

Producta parvula A. Winchell, Proc. Acad. Nat. Sci. Philadelphia, 1863, p. 4.

Loc. Burlington, Iowa.

Productus parvus Meek and Worthen. Kaskaskia (L. Carb.).

Productus parvus Meek and Worthen, Proc. Acad. Nat. Sci. Philadelphia, 1860, p. 450;—Geol. Survey Illinois, II, 1866, p. 297, pl. 23, fig. 4.—White, Wheeler's Expl. and Survey west 100th Merid., IV, 1875, p. 83, pl. 5, fig. 6.

Loc. Chester, Illinois; Mountain Spring, Nevada.

Productus (?) pectinoideus Shepard.

Producta pectenoidea Shepard, American Jour. Sci., XXXIV, 1838, p. 150, fig. 4.

Loc. Vermilionville, Lasalle County, Illinois.

Obs. The geological position of this species may be Trenton or Upper Carboniferous. The illustration is unsatisfactory.

Productus pertenuis Meek. Upper Carboniferous.

Productus cancrini Geinitz (non de Verneuil), Carbon und Dyas in Nebraska, 1866, p. 54, pl. 4, fig. 6.

Productus pertenuis Meek, Final Rep. U. S. Geol. Survey Nebraska, 1872, p. 164, pl. 1, fig. 14; pl. 8, fig. 9.

Loc. Nebraska City, Nebraska; Leavenworth, Kansas; Kansas City, Missouri.

Productus peruvianus d'Orbigny. Upper Carboniferous.

Productus peruvianus d'Orbigny, Voyage dans l'Amérique Méridionale, Pal., 1842, p. 52, pl. 4, fig. 4.

Loc. Yarbichambi, Bolivia.

Obs. Probably a synonym for Productus semireticulatus.

Productus phillipsi Norwood and Pratten. Carboniferous.

Productus phillipsii Norwood and Pratten, Jour. Acad. Nat. Sci. Philadelphia, III, 1854, p. 8, pl. 1, fig. 2.

Loc. Big Canyon, Humboldt River, Utah.

Productus pileiformis McChesney=Productus cora.

Productus pileolus Shumard. Upper Carboniferous.

Productus pileolus Shumard, Trans. St. Louis Acad. Sci., I, 1858, p. 291.

Loc. Guadalupe Mountains, Texas.

Productus pocillum Morton. Upper Carboniferous.

Productus pocillum Morton, Amer. Jour. Sci., XXIX, 1836, p. 150, pl. 2, fig. 2.

Loc. Putnam Hill, Ohio.

Obs. Not recognizable.

Productus popei Shumard. Upper Carboniferous.

Productus popei Shumard, Trans. St. Louis Acad. Sci., I, 1858, p. 290, pl. 11, fig. 8.

Loc. New Mexico and Texas.

Productus portlockianus Norwood and Pratten=Productus costatus.

Productus prattenianus Norwood=Productus cora.

Productus punctatus (Martin). Upper Carboniferous.

Anomites punctatus Martin, Petrefacta Derbiensia, 1809, p. 8, pl. 37, fig. 6.

Productus punctatus? Morton, American Jour. Sci., XXIX, 1836, p. 153, pl. 26, fig. 38.

Productus punctatus Shumard, Marcy's Rep. U. S. Expl. Red River, Louisiana, 1853, p. 201, pl. 1, fig. 5; pl. 2, fig. 1.—Norwood and Pratten, Jour. Acad. Nat. Sci. Philadelphia, III, 1854, p. 19.—Marcou, Geol. North America, 1858, p. 48, pl. 6, fig. 12.—Geinitz, Carbon und Dyas in Nebraska, 1866, p. 55.—McChesney, Trans. Chicago Acad. Sci., I, 1868, p. 27, pl. 1, figs. 10, 11.—Meek, Final Rep. U. S. Geol. Survey Nebraska, 1872, p. 169, pl. 2, fig. 6; pl. 4, fig. 5.—Meek and Worthen, Geol. Survey Illinois, V, 1873, p. 569, pl. 25, fig. 13.—White, Wheeler's Expl. and Survey west 100th Meridian, IV, 1875, p. 114, pl. 7, fig. 2;—Eleventh Rep. State Geol. Indiana, 1882, p. 373, pl. 42, figs. 1–3.—Hall, Second Ann. Rep. N. Y. State Geol. 1883, pl. 50, figs. 14–16.—White, Thirteenth Rep. State Geol. Indiana, 1884, p. 124, pl. 27, figs. 1–3.—Herrick, Bull. Denison Univ., II, 1887, p. 48, pl. 2, fig. 29.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 17A, fig. 21; pl. 19, figs. 14–18.—Keyes, Geol. Survey Missouri, V, 1895, p. 51, pl. 37, fig. 1.—Smith, Proc. American Phil. Soc., XXXV, 1897, p. 29 (extract).

Productus semipunctatus Sheppard, American Jour. Sci., XXXIV, 1838, p. 153, fig. 9.

Productus tubulospinus McChesney, New Pal. Fossils, 1860, p. 37.

Productus allied to punctatus Etheridge, Quart. Jour. Geol. Soc. London, XXXIV, 1878, p. 630.

Loc. Europe; Ohio; Indiana; Illinois; Missouri; Arkansas; Nebraska; Iowa; Nevada; New Mexico; Feilden Isthmus, lat. 82° 43′.

Productus pustulosus Phillips. Upper Carboniferous.

Producta pustulosa Phillips, Geol. Yorkshire, II, 1836, p. 216, pl. 7, fig. 15.

Productus pustulosus Marcou, Geol. North America, 1858, p. 48, pl. 6, fig. 1.—Geinitz, Carbon und Dyas in Nebraska, 1866, p. 55.

Productus pyxidiformis Marcou, Geol. North America, 1858, p. 48, pl. 6, fig. 3.

Productus pustulosus? Meek and Hayden, Proc. Acad. Nat. Sci. Philadelphia, 1859, p. 26.

Loc. Europe; Leavenworth, Kansas; Tigeras, New Mexico.

Obs. See Productus norwoodi.

Productus pyxidatus Hall=Productella pyxidata.

Productus pyxidiformis de Koninck=Productus pustulosus.

Productus raricostatus Herrick. Waverly (L. Carb.).

Productus raricostatus Herrick, Bull. Denison Univ., IV, 1888, p. 19, pl. 3, fig. 19;—Geol. Ohio, VII, 1895, pl. 22, fig. 9.

Loc. Moots Run, Ohio.

Productus rarispinus Hall=Productella rarispina.

Productus reticulatus Gabb. Upper Carboniferous.

Productus reticulatus Gabb, Jour. Acad. Nat. Sci. Philadelphia, 2d ser., VIII, 1881, p. 302, pl. 42, fig. 13.

Loc. Lake Titicaca, Bolivia.

Productus rhomianus Derby. Upper Carboniferous.

Productus rhomianus Derby, Bull. Cornell Univ., I, 1874, p. 56, pl. 3, figs. 20, 41–44, 49.

Loc. Bomjardim and Itaituba, Brazil.

Productus rogersi Norwood and Pratten=Productus nebraskaensis.

Productus rushvillensis Herrick. Waverly (L. Carb.).

Productus rushvillensis Herrick, Bull. Denison Univ., IV, 1888, p. 22, pl. 3, fig. 15;—Geol. Ohio, VII, 1895, pl. 23, fig. 15.

Loc. Rushville, Newark, and Loudonville, Ohio.

Productus scabriculus (Martin). Lower and Upper Carboniferous.

Anomites scabriculus Martin, Petrefacta Derbiensia, 1809, p. 8, pl. 36, fig. 5.

Productus scabriculus Norwood and Pratten, Jour. Acad. Nat. Sci. Philadelphia, III, 1854, p. 17.—Marcou, Geol. North America, 1858, p. 47, pl. 5, fig. 6.—Newberry, Ives's Rep. Colorado River of the West, 1861, p. 125.

Productus scabriculus? Geinitz, Carbon und Dyas in Nebraska, 1866, p. 54.

Loc. Europe; Pecos Village and Santa Fe, New Mexico; Plattsmouth, Nebraska; Caldwell County, Kentucky; Kashmere.

Productus scitulus Meek and Worthen. St. Louis (L. Carb.).

Productus scitulus Meek and Worthen, Proc. Acad. Nat. Sci. Philadelphia, 1860, p. 451;—Geol. Survey Illinois, II, 1866, p. 280, pl. 20, fig. 5.

Loc. Alton, Illinois.

Productus semipunctatus Sheppard=Productus punctatus.

Productus semireticulatus Hall, 1852 (non Martin)=Productus cora.

Productus semireticulatus (Martin). Lower and Upper Carboniferous.

Anomites semireticulatus Martin, Petrefacta Derbiensia, 1809, p. 7, pl. 32, figs. 1, 2; pl. 33, fig. 4.

Productus inca d'Orbigny, Voyage dans l'Amérique Méridionale, Pal., 1842, p. 51, pl. 4, figs. 1–3.—Derby, Bull. Mus. Comp. Zool., III, 1876, p. 280.

Productus semireticulatus Norwood and Pratten, Jour. Acad. Nat. Sci. Philadelphia, III, 1854, p. 11.—Hall, Pacific R. R. Reports, III, 1856, p. 103, pl. 2, figs. 16, 17;—Geol. Survey Iowa, I, Pt. II, 1858, p. 637.—Marcou, Geol. North America, 1858, p. 46, pl. 5, fig. 4; pl. 6, fig. 6.—Shumard, Trans. St. Louis Acad. Sci., I, 1858, p. 292.—Newberry, Ives's Rep. Colorado River of the West, 1861, p. 124.—Salter, Quart. Jour. Geol. Soc. London, XVII, 1861, p. 64, pl. 4, fig. 1.—Davidson, Ibidem, XIX, 1863, p. 174, pl. 9, figs. 20, 21.—Meek, Pal. California, I, 1864, p. 11, pl. 2, fig. 4.—Winchell, Proc. Acad. Nat. Sci. Philadelphia, 1865, p. 115.—Geinitz, Carbon und Dyas in Nebraska, 1866, p. 51.—Toula, Sitzb. der k. k. Akad. der Wissensch. zu Wien, IX, 1869, p. 9.—Meek, Final Rep. U. S. Geol. Survey Nebraska, 1872, p. 160, pl. 5, fig. 7.—Derby, Bull. Cornell Univ., I, 1874, p. 47, pl. 4, fig. 8; pl. 6, fig. 18; pl. 7, figs. 5–7, 15, 16.—White, Wheeler's Expl. and Survey west of the 100th Meridian, IV, 1875, p. 111, pl. 8, fig. 1.—Meek, King's U. S. Geol. Expl. 40th Parl., IV, 1877, p. 69, pl. 7, fig. 5.—Hall and Whitfield, Ibidem, 1867, p. 267, pl. 5, figs. 5, 6.—Dawson, Acadian Geol., 3d ed., 1878, p. 296, fig. 97.—Etheridge, Quart. Jour. Geol. Soc. London, XXXIV, 1878, p. 629.—Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 49, figs. 11–13; pl. 50, figs. 19–23.—White, Thirteenth Rep. State Geol. Indiana, 1884, p. 125, pl. 24, figs. 1–3.—Herrick, Bull. Denison Univ., III, 1888, p. 31, pl. 1, fig. 26; pl. 3, fig. 24; pl. 7, fig. 11; pl. 10,

Productus semireticulatus (Martin)—Continued.

fig. 6.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 17A, figs. 16–18; pl. 18, figs. 11–13; pl. 19, figs. 19–23.—Keyes, Geol. Survey Missouri, V, 1895, p. 50, pl. 36, fig. 4.

Productus calhounianus Swallow, Trans. St. Louis Acad. Sci., I, 1858, pp. 181, 215.—Meek and Hayden, Proc. Acad. Nat. Sci. Philadelphia, 1859, p. 26.—Newberry, Ives's Rep. Colorado River of the West, 1861, p. 123.

Productus setigerus Hall, Geol. Survey Iowa, I, Pt. II, 1858, p. 638, pl. 19, fig. 3.

Productus setigerus var. keokuk Hall, Geol. Survey Iowa, I, Pt. II, 1858, p. 639, pl. 19, fig. 4.

Productus martini A. Winchell, Proc. Acad. Nat. Sci. Philadelphia, 1863, p. 4.

Productus magnus Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 17A, fig. 15.

Loc. Europe; throughout the Carboniferous of North America; Feilden Isthmus, lat. 82° 43′; Vixixil and Sansiguan, Guatemala; Yarbichambi, Bolivia; Bomjardim and Itaituba, Brazil; Tibet and Kashmere.

Obs. See Productus peruvianus d'Orbigny and P. magnicostatus.

Productus semireticulatus kansasensis Swallow. Upper Carboniferous.

Productus calhounianus var. kansasensis Swallow, Trans. St. Louis Acad. Sci., I, 1858, p. 216.

Loc. Kansas and Missouri.

Productus semistriatus Meek. Upper Carboniferous.

Productus semistriatus Meek, Proc. Acad. Nat. Sci. Philadelphia, 1860, p. 309.—Meek, Simpson's Rep. Expl. Great Basin Terr. Utah, 1876, p. 349, pl. 1, fig. 7;—King's U. S. Geol. Expl. 40th Parl., IV, 1877, p. 74, pl. 7, fig. 8.—White, Wheeler's Expl. and Survey west 100th Meridian, 1881, Appendix, p. V.

Loc. Utah and northern New Mexico.

Productus setigerus Hall=Productus semireticulatus.

Productus setigerus var. keokuk Hall=Productus semireticulatus.

Productus shumardianus Hall=Productella shumardana.

Productus speciosus Hall=Productella speciosa.

Productus spinulicostus Hall=Productella spinulicosta.

Productus splendens Norwood and Pratten=Productus longispina.

Productus subaculeatus of American authors=Productella spinulicosta.

Productus subalatus Hall=Productella subalata.

Productus subhorridus Meek. Carboniferous.

Productus subhorridus Meek, King's U. S. Geol. Expl. 40th Parl., IV, 1877, p. 75, pl. 7, fig. 3.

Loc. Wasatch Mountains, Utah.

Productus sulcatus Castelnau=Leptæna rhomboidalis.

Productus sulcifer de Verneuil=Leptæna rhomboidalis.

Productus swallovi Beecher. Kaskaskia (L. Carb.).

Koninckina americana Swallow, Trans. St. Louis Acad. Sci., II, 1863, p. 94.

Productus swallovi Beecher, American Jour. Sci., 3d ser., XL, 1890, p. 214.

Loc. Barretts Station, St. Louis County, Missouri.

Productus symmetricus McChesney. Upper Carboniferous.

Productus symmetricus McChesney, New Pal. Fossils, 1860, p. 35;—Trans. Chicago Acad. Sci., I, 1868, p. 25, pl. 1, fig. 9.—Meek, Final Rep. U. S. Geol. Survey of Nebraska, 1872, p. 167, pl. 5, fig. 6; pl. 8, fig. 13.—White, Thirteenth Rep. State Geol. Indiana, 1884, p. 123, pl. 25, figs. 1 and 2.—Hall and

Productus symmetricus McChesney—Continued.

Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 17A, figs. 19, 20.—Keyes, Geol. Survey Missouri, V, 1895, p. 48, pl. 36, fig. 2.

Loc. Lasalle and Springfield, Illinois; Iowa; Missouri; Nebraska; Indiana.

Productus tenuicostatus Hall. St. Louis (L. Carb.).

Productus tenuicostatus Hall, Geol. Survey Iowa, I, Pt. II, 1858, p. 675, pl. 24, fig. 2;—Second Ann. Rep. N. Y. State Geol., 1883, pl. 49, fig. 18.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 18, fig. 18.—Keyes, Geol. Survey Missouri, V, 1895, p. 44.

Loc. Milan, Illinois.

Productus truncatus Hall=Strophalosia truncata.

Productus tubulospinus Sheppard=Productus punctatus.

Productus undiferus de Koninck. Upper Carboniferous.

Productus undiferus de Koninck, Mém. de la Soc. Royale des Sciences de Liége, IV, 1846, p. 153, pl. 5, fig. 4; pl. 11, fig. 5.—Norwood and Pratten, Jour. Acad. Nat. Sci. Philadelphia, III, 1854, p. 9.

Loc. Europe; Caseyville, Illinois; Posey County, Indiana.

Obs. See Productus boonensis Swallow.

Productus villiersi d'Orbigny. Upper Carboniferous.

Productus villiersi d'Orbigny, Voyage dans l'Amérique Méridionale, Pal., 1842, p. 53, pl. 4, figs. 12, 13.—de Koninck, Recherches sur les Animaux Fossiles, Pt. I, 1847, p. 109, pl. 11, fig. 1.—Norwood and Pratten, Jour. Acad. Nat. Sci. Philadelphia, III, 1854, p. 17.

Loc. Yarbichambi, Bolivia; Keg Creek, Missouri.

Productus viminalis White. Burlington (L. Carb.).

Productus viminalis White, Proc. Boston Soc. Nat. Hist., IX, 1862, p. 29.

Loc. Burlington, Iowa.

Obs. White regards this species as a synonym for Productus costatus Sowerby.

Productus vittatus Hall=Productus alternatus.

Productus wabashensis Norwood and Pratten=Productus longispina.

Productus wallacianus Derby. Upper Carboniferous.

Productus wallacianus Derby, Bull. Cornell Univ., I, 1874, p. 57, pl. 3, figs. 46–48; pl. 6, fig. 5.

Loc. Bomjardim and Itaituba, Brazil.

Productus wilberanus McChesney=Productus nebraskaensis.

Productus wortheni Hall. Keokuk (L. Carb.).

Productus wortheni Hall, Geol. Survey Iowa, I, Pt. II, 1858, p. 635, pl. 19, fig. 1.

Loc. Nauvoo, Illinois.

Obs. Compare with Productus marginicinctus Prout.

Productus weyprechti Toula. Upper Carboniferous.

Productus weyprechti Toula, Sitzb. der k. k. Akad. der Wissensch. zu Wien, 1873, p. 138, pl. 1, fig. 4.

Productus weyprechti? Etheridge, Quart. Jour. Geol. Soc. London, XXXIV, 1878, p. 631.

Loc. Cape Joseph Henry, lat. 82° 50′.

PROTORHYNCHA Hall and Clarke. Genotype Atrypa dubia Hall.

Protorhyncha Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 180;—Thirteenth Ann. Rep. N. Y. State Geologist, 1895, p. 824.

Protorhyncha (?) antiquata (Billings). Lower Cambrian.

Camarella antiquata Billings, Pal. Fossils, I, 1861, p. 10, fig. 13;—Geol. Vermont, II, 1861, p. 949, fig. 353;—Geol. Canada, 1863, p. 284, fig. 290.—Walcott, Bull. U. S. Geol. Survey, 30, 1886, p. 122, pl. 7, fig. 8;—Tenth Ann. Rep. U. S. Geol. Survey, 1891, p. 613, pl. 72, fig. 3.

Camarella ? antiquata Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 220.

Loc. Swanton, Vermont.

Protorhyncha dubia Hall. Chazy (Ord.).

Atrypa dubia Hall, Pal. New York, I, 1847, p. 21, pl. 4 bis, fig. 5.

Rhynchonella dubia Hall, Twelfth Rep. N. Y. State Cab. Nat. Hist., 1859, p. 65.

Protorhyncha dubia Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 180.

Loc. Chazy, New York; Highbridge, Kentucky; Lascassas, Tennessee.

Protorhyncha (?) minor (Walcott). Lower Cambrian.

Camarella (?) minor Walcott, Proc. U. S. Nat. Mus., XII, 1889, p. 36;—Tenth Ann. Rep. U. S. Geol. Survey, 1891, p. 614, pl. 72, fig. 4.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 221.

Loc. Stissingville, New York.

Obs. May be the type of a new genus. Its affinities are rather with the Rhynchonellidæ than with Pentameridæ.

Protorthis Hall and Clarke=Billingsella.

Protosiphon Matthew. Genotype P. kempanus Matthew.

Protosiphon Matthew, Geol. Mag., dec. IV, IV, 1897, p. 70.

Protosiphon kempanus Matthew. Lower Cambrian.

Protosiphon kempanum Matthew, Geol. Mag., dec. IV, IV, 1897, p. 70, figs. 1–4.

Loc. Long Island, Kings County, New Brunswick.

Protozyga Hall and Clarke=Zygospira.

Pseudocrania anomala A. Winchell=Orthothetes anomalus.

PTYCHOSPIRA Hall and C. Genotype Terebratula ferita von Buch.

Ptychospira Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 112, fig. 102;—Thirteenth Ann. Rep. N. Y. State Geologist, 1895, p. 792.

Ptychospira sexplicata (White and Whitfield.) Waverly (L. Carb.).

Retzia sexplicata White and Whitfield, Proc. Boston Soc. Nat. Hist., VIII, 1862, p. 294.

Ptychospira sexplicata Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 112, pl. 50, figs. 13, 14; pl. 83, fig. 28.

Loc. Burlington, Iowa.

PUGNAX Hall and C. Genotype Rhynchonella acuminata (Martin).

Pugnax Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 202;—Thirteenth Ann. Rep. N. Y. State Geologist, 1895, p. 828.

Obs. Subgenus of Hypothyris.

Pugnax (?) dawsoniana (Davidson). Upper Carboniferous.

Rhynchonella dawsoniana Davidson, Quart. Jour. Geol. Soc. London, XIX, 1863, p. 172, pl. 9, figs. 13, 14.

Rhynchonella ? dawsoniana Dawson, Acadian Geology, 3d ed., 1878, p. 294, fig. 93.

Pugnax (?) dawsonianus Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 214, pl. 62, figs. 30–33.

Loc. Lennox Passage, Nova Scotia.

Pugnax globulina (Phillips sp.?) (Davidson). Upper Carboniferous.

?Terebratula globulina Phillips, Encyl. Metr., IV, 1834, pl. 3, fig. 3.

Camarophoria? globulina? Davidson, Quart. Jour. Geol. Soc. London, XIX, 1863, p. 171, pl. 9, figs. 11, 12.

Camarophoria globulina? Dawson, Acadian Geology, 3d ed., 1878, p. 293, fig. 92.

Pugnax globulina Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 214.

Loc. De Bert River, Nova Scotia.

Pugnax grosvenori Hall. St. Louis (L. Carb.).

Rhynchonella grosvenori Hall, Trans. Albany Institute, IV, 1858, p. 10.—Whitfield, Bull. American Mus. Nat. Hist., I, 1882, p. 53, pl. 6, figs. 31–34.—Hall, Twelfth Rep. State Geol. Indiana, 1883, p. 331, pl. 29, figs. 31–34.

Pugnax grosvenori Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 60, figs. 13–17.

Loc. Spergen Hill and Bloomington, Indiana; Alton, Illinois; near Princeton, Kentucky.

Pugnax mutata Hall. Keokuk and St. Louis (L. Carb.).

Rhynchonella mutata Hall, Trans. Albany Institute, IV, 1858, p. 10;—Geol. Survey Iowa, I, Pt. II, 1858, p. 658, pl. 23, fig. 2.—Whitfield, Bull. American Mus. Nat. Hist., I, 1882, p. 52, pl. 6, fig. 46.—Hall, Twelfth Rep. State Geol. Indiana, 1883, p. 332, pl. 29, figs. 43–45.

Pugnax mutatus Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 204, pl. 60, figs. 18–22.

Loc. Alton and Warsaw, Illinois; Boonville, Missouri.

Pugnax ottumwa (White). St. Louis (L. Carb.).

Rhynchonella ottumwa White, Proc. Boston Soc. Nat. Hist., IX, 1862, p. 23;—Twelfth Ann. Rep. U. S. Geol. Survey Terr., 1883, p. 165, pl. 41, fig. 5.

Pugnax ottumwa Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 204, pl. 60, figs. 23–26.

Loc. Ottumwa and Oskaloosa, Iowa; Clark County, Missouri.

Pugnax pugnus (Martin). Upper Devonian.

Conchyliolithus Anomites pugnus Martin, Petrefacta Derbiensia, 1809, tab. 22, figs. 4, 5.

Terebratula pugnus Sowerby, Mineral Conchology, 1825, pl. 425, figs. 1–6.

Rhynchonella pugnus Davidson, Mon. British Carb. Brach., Pal. Soc., 1860, p. 97, pl. 32, figs. 1–15.—Williams, American Jour. Sci., 3d ser., XXV, 1883, p. 99.—Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 155, pl. 14, fig. 7.—Clarke, Bull. U. S. Geol. Survey, 16, 1885, p. 73.—Whiteaves, Cont. Canadian Pal., I, 1891, pp. 230, 290.

?Rhynchonella pugnus Dawson, Acadian Geology, 3d ed., 1878, p. 295.

Pugnax pugnus Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 203, pl. 60, figs. 6–10.

Loc. Europe; High Point, New York; Eureka district, Nevada; Mackenzie and Athabasca rivers, Canada; in the Carboniferous of Windsor and East River, Nova Scotia (Dawson); San Saba Valley, Texas (Roemer).

Pugnax pugnus alta (Calvin). Upper Devonian.

Rhynchonella alta Calvin; paper read before the Iowa Acad. Sci., and a named photographic plate distributed.

Rhynchonella pugnus var. alta Williams, Bull. Geol. Soc. America, I, 1890, pl. 12, figs. 5–7.

Pugnax altus Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 203, pl. 60, figs. 1–5.

Loc. Solon, Iowa.

Pugnax pugnus missouriensis (Shumard). Waverly (L. Carb.).

Rhynchonella missouriensis Shumard, Geol. Rep. Missouri, 1855, p. 204, pl. 5C, fig. 5a (non figs. 5b, 5c = Pugnax striaticostata).—Meek and Worthen, Geol. Survey Illinois, II, 1866, p. 153, pl. 14, fig. 4.—Keyes, Geol. Survey Missouri, V, 1895, p. 100.

Pugnax missouriensis Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 204, pl. 60, figs. 33, 34; pl. 62, figs. 44, 45.

Loc. Cooper County, Missouri; Burlington, Iowa; Rockford, Indiana; Sciotoville and Richfield, Ohio.

Pugnax rockymontana (Marcou). Upper Carboniferous.

Terebratula rockymontana Marcou, Geol. N. America, 1858, p. 50, pl. 6, fig. 13.

Rhynchonella eatoniæformis McChesney, New Pal. Fossils, 1860, p. 49.

Rhynchonella rockymontana White, Wheeler's Expl. and Survey west 100th Merid., IV, 1875, p. 131, pl. 9, fig. 1.

Pugnax eatoniiformis Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 204, pl. 60, figs. 11, 12.

Loc. Pecos Village, New Mexico; Cedar Range, Utah; Graysville, Illinois.

Pugnax striaticostata (Meek and Worthen). Kinderhook (L. Carb.).

Rhynchonella missouriensis Shumard, Geol. Rep. Missouri, 1855, p. 204, Pl. C, figs. 5b, 5c (non 5a=Pugnax pugnus missouriensis).—Meek and Worthen, Geol. Survey Illinois, III, 1868, p. 450, pl. 14, fig. 7.

Rhynchonella striatocostata Meek and Worthen, Ibidem, III, 1868, p. 452.

Pugnax striatocostata Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 204.

Loc. Cooper County, Missouri.

Pugnax swallovana (Shumard). Upper Carboniferous.

Camarophoria swallovana Shumard, Trans. St. Louis Acad. Sci., I, 1859, p. 394, pl. 11, fig. 1.

Pugnax swalloviana Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, p. 204, pl. 60, figs. 27–32.

Loc. Guadalupe Mountains of New Mexico and Texas.

Pugnax utah (Marcou). Upper Carboniferous.

Terebratula utah Marcou, Geol. N. America, February, 1858, p. 51, pl. 6, fig. 12.

Rhynchonella (Camarophoria) osagensis Swallow, Trans. St. Louis Acad. Sci., I, June, 1858, p. 219.

Rhynchonella utah, Meek and Hayden, Proc. Acad. Nat. Sci. Philadelphia, 1859, p. 27.—Newberry, Ives's Rep. Colorado River of the West, 1861, p. 128.—White, Wheeler's Expl. and Survey west 100th Meridian, IV, 1875, p. 128, pl. 9, fig. 2;—Thirteenth Rep. State Geol. Indiana, 1884, p. 132, pl. 25, fig. 6.

†Rhynchonella species Salter, Quart. Jour. Geol. Soc. London, XVII, 1861, p. 64, pl. 4, fig. 5.

Camarophoria globulina Geinitz (non Phillips), Carbon und Dyas in Nebraska, 1866, p. 38, pl. 3, fig. 5.

Rhynchonella osagensis Meek, Final Rep. U. S. Geol. Survey Nebraska, 1872, p. 179, pl. 1, fig. 9; pl. 6, fig. 2.—Meek and Worthen, Geol. Survey Illinois, V, 1873, p. 571, pl. 26, fig. 22.

Pugnax utah Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 204, pl. 60, figs. 39–42.

Rhynchonella uta Keyes, Geol. Survey Missouri, V, 1895, p. 103, pl. 41, fig. 7.

Loc. Salt Lake City, Utah; Indiana; Illinois; Iowa; Missouri; Kansas; Arkansas; Nebraska.

Obs. Compare with Pugnax pleurodon.

RAFINESQUINA Hall and C. Genotype Strophomena alternata Emmons.

Strophomena (non Rafinesque) Billings, Canadian Nat. Geol., I, 1856, p. 133;—Canadian Jour., VI, 1861, p. 329;—Pal. Fossils, I, 1862, p. 115.—Hall, Pal. New York, IV, 1867, p. 76.—Meek, Pal. Ohio, I, 1873, p. 73.—N. H. Winchell, Ninth Ann. Rep. Geol. Nat. Hist. Survey Minnesota, 1881, p. 118.—Shaler, Fossil Brachiopoda of the Ohio Valley, 1887, p. 4.—Herrick, Bull. Denison University, IV, 1888, p. 14.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 159.

Rafinesquina Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 281.—Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 400.—Hall and Clarke, Eleventh Ann. Rep. N. Y. State Geologist, 1894, p. 279.

Rafinesquina alternata (Emmons). Trenton to Lorraine (Ord.).

Leptæna alternata Conrad, Second Ann. Rep. N. Y. Geol. Survey, 1838, p. 115 (undefined).—Hall, Pal. New York, I, 1847, pp. 102, 286, pl. 31, fig. 1; pl. 31A, fig. 1; pl. 79, fig. 2.—Rogers, Geol. Pennsylvania, II, Pt. II, 1858, p. 818, fig. 600.

Strophomena alternata Conrad, Third Ann. Rep. N. Y. Geol. Survey, 1839, p. 63 (undefined);—Fourth Rep. Ibidem, 1840, p. 201 (undefined);—Fifth Rep. Ibidem, 1841, p. 37 (undefined).—Emmons, Geol. N. Y.; Rep. Second Dist., 1842, p. 395, fig. 3.—Billings, Canadian Nat. Geol., I, 1856, p. 204, figs. 3, 4;—Canadian Nat. Geol., V, 1860, p. 51;—Pal. Fossils, I, 1862, p. 117;—Geol. Canada, 1863, p. 163, fig. 140.—Meek, Pal. Ohio, I, 1873, p. 88, pl. 7, fig. 1.—Miller, Cincinnati Quart. Jour. Sci., II, 1875, p. 51.—White, Second Ann. Rep. Indiana Bureau of Statistics and Geol., 1880, p. 481, pl. 1, figs. 6, 7;—Tenth Rep. State Geol. Indiana, 1881, p. 113, pl. 1, figs. 6, 7.—Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 38, figs. 6–11.—Shaler, Fossil Brachiopoda of the Ohio Valley, 1887, p. 4, pls. 2, 3.—Keyes, Geol. Survey Missouri, V, 1895, p. 70, pl. 39, fig. 3.

Orthis huroniensis Castelnau, Essai Système Silurien l'Amérique Septentrionale, 1843, p. 37, pl. 14, fig. 6.

Orthis plana Castelnau (non Pander), Ibidem, 1843, p. 38, pl. 14, fig. 1.

Strophomena angulata? Owen, Geol. Expl. Iowa, Wisconsin, and Illinois, 1844, pl. 18, figs. 1, 3.

Strophomena anticostiensis Shaler, Bull. Mus. Comp. Zool., 4, 1865, p. 62.

Rafinesquina alternata Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 282, pl. 8, figs. 6–11, 27, 28; Pt. II, 1895, pl. 84, figs. 17, 18.—Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 404, pl. 31, figs. 32–34.—Whiteaves, Pal. Foss., III, Pt. III, 1897, p. 171.

Loc. New York; Ohio; Indiana; Illinois; Missouri; Wisconsin; Minnesota; Canada; Manitoba; Anticosti.

Obs. This species was not defined or figured by Conrad. The first illustration was given by Emmons, and in the following year it was figured and defined by Castelnau as Orthis huroniensis.

Rafinesquina alternata alternistriata Hall. Lorraine (Ord.).

Leptæna alternistriata Hall, Pal. New York, I, 1847, p. 109, pl. 31B, fig. 1.

Strophomena alternistriata Hall, Twelfth Rep. N. Y. State Cab. Nat. Hist., 1859, p. 70.

Strophomena alternata var. alternistriata Miller, Cincinnati Quart. Jour. Sci., II, 1875, p. 53.

Rafinesquina alternistriata Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 283.

Loc. Cincinnati, Ohio; Maysville, Kentucky; Madison, Indiana.

Obs. Meek regarded this variety as a synonym for S. alternata.

Rafinesquina alternata fracta (Meek). Lorraine (Ord.).

Strophomena alternata var. fracta Meek, Pal. Ohio, I, 1873, p. 91, pl. 7, fig. 3.

Strophomena fracta Miller, Cincinnati Quart. Jour. Sci., I, 1874, p. 13;—Ibidem, II, 1875, p. 54.

Loc. Cincinnati, Ohio.

Rafinesquina alternata loxorhytis Winchell and Schuchert=R. kingi.

Rafinesquina alternata loxorhytis (Meek). Lorraine (Ord.).

Strophomena alternata var. loxorhytis Meek, Pal. Ohio, I, 1873, p. 91.—Miller, Cincinnati Quart. Jour. Sci., II, 1875, p. 53.

Loc. Cincinnati, Ohio.

Rafinesquina alternata nasuta (Conrad). Lorraine (Ord.).

Strophomena nasuta Conrad, Jour. Acad. Nat. Sci. Philadelphia, VIII, 1842, p. 260.—Emmons, Geol. New York; Rep. Third Dist., 1842, p. 403, fig. 3.

Strophomena alternata var. nasuta Miller, Cincinnati Quart. Jour. Sci., II, 1875, p. 53.

Loc. Jefferson County, New York; Cincinnati, Ohio.

Rafinesquina (?) atava (Matthew). Calciferous (Ord.).

Strophomena atava Matthew, Trans. Royal Soc. Canada, 1893, p. 102, pl. 7, fig. 8.

Loc. Mary Island, near St. John, New Brunswick.

Rafinesquina aurora (Billings). Calciferous (Ord.).

Strophomena aurora Billings, Pal. Fossils, I, 1865, p. 218, fig. 202.

Loc. Table Head, etc., Newfoundland.

Rafinesquina ceres (Billings). Lorraine and Anticosti (Ord. and Sil.).

Strophomena ceres Billings, Canadian Nat. Geol., V, 1860, p. 54;—Pal. Fossils, I, 1862, p. 119.

Loc. Anticosti.

Rafinesquina deltoidea (Conrad). Trenton and Utica (Ord.).

Strophomena deltoidea Conrad, Third Ann. Rep. N. Y. Geol. Survey, 1839, p. 64;—Fifth Rep., Ibidem, 1841, p. 37.—Vanuxem, Geol. N. Y.; Rep. Third Dist., 1842, p. 46, fig. 2.—Emmons, Geol. N. Y.; Rep. Second Dist., 1842, p. 389, fig. 2.—Billings, Geol. Canada, 1863, p. 163, fig. 141.—Keyes, Geol. Survey Missouri, V, 1895, p. 69.

Strophomena camerata Conrad, Jour. Acad. Nat. Sci. Philadelphia, VIII, 1842, p. 254, pl. 14, fig. 5.

Leptæna camerata Hall, Pal. New York, I, 1847, p. 106, pl. 31A, fig. 2.

Leptæna deltoidea Hall, Ibidem, 1847, p. 106, pl. 31A, fig. 3.

Streptorhynchus (Strophonella) deltoidea Hall, Second Ann. Rep. New York State Geol., 1883, pl. 42, figs. 1, 2, 4 (non fig. 3).

Refinesquina deltoidea Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 9A, figs. 1, 2, 4.—Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 403, pl. 31, figs. 30, 31.—Whiteaves, Pal. Foss., III, Pt. III, 1897, p. 170.

Loc. Trenton Falls, etc., New York; St. Paul, Cannon Falls, etc., Minnesota; Oshkosh, Wisconsin; Dubuque, Iowa; Pike County, Missouri; Ottawa and Lake Winnipeg, Canada.

Rafinesquina fasciata Hall. Chazy (Ord.).

Leptæna fasciata Hall, Pal. New York, I, 1847, p. 20, pl. 4 bis, fig. 3.

Strophomena fasciata Hall, Twelfth Rep. N. Y. State Cab. Nat. Hist., 1859, p. 70.

Rafinesquina fasciata Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 283.

Loc. Chazy, Clinton County, New York.

Obs. Should be compared with R. alternata.

Rafinesquina imbrex (Pander). Lorraine (Ord.).

Strophomena imbrex(?) Billings, Pal. Fossils, I, 1862, p. 128, fig. 106.

Loc. Europe; Anticosti.

Rafinesquina incrassata (Hall). Chazy and Black River (Ord.

Leptæna incrassata Hall, Pal. New York, I, 1847, p. 19, pl. 4 bis, fig. 2.—Rogers Geol. Pennsylvania, II, Pt. II, 1858, p. 817, fig. 591.

Strophomena incrassata Billings, Canadian Nat. Geol., IV, 1859, p. 443.

Loc. Chazy, New York; Mingan Island, Canada.

Rafinesquina kingi (Whitfield). Lorraine (Ord.).

Strophomena kingi Whitfield, Ann. Rep. Geol. Survey Wisconsin, 1877, p. 72;—Geol. Wisconsin, IV, 1882, p. 261, pl. 12, figs. 15, 16.

Rafinesquina alternata var. loxorhytis Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 407, pl. 31, figs. 35-37; pl. 32, figs. 59, 60.

Rafinesquina kingi Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 283.

Loc. Delafield, Wisconsin; near Spring Valley, Minnesota.

Rafinesquina lata Whiteaves. Lorraine (Ord.).

Rafinesquina lata Whiteaves, Canadian Rec. Sci., 1895, p. 392;—Whiteaves, Pal. Foss., III, Pt. III, 1897, p. 172, pl. 19, figs. 2-5.

Loc. Red River Valley and Lake Winnipeg, Manitoba.

Rafinesquina mesicosta (Shumard). ? Trenton (Ord.).

Leptæna mesacosta Shumard, Geol. Rep. Missouri, 1855, p. 205, Pl. C, fig. 2.—Keyes, Geol. Survey Missouri, V, 1895, p. 76.

Loc. Cape Girardeau, Missouri.

Rafinesquina minnesotaensis (N. H. Winchell). Trenton (Ord.).

Strophomena deltoidea Owen (non Conrad), Geol. Expl. Iowa, Wisconsin, and Illinois, 1844, pl. 16, fig. 8; pl. 17, fig. 6.

Leptæna deltoidea Owen, Geol. Rep. Wisconsin, Iowa, and Minnesota, 1852, p. 620, tab. 2B, fig. 10 (not the middle figure).

Strophomena incrassata Hall (non 1847), Geol. Wisconsin, I, 1862, p. 42, fig. 16.—Hall (non 1847), Second Ann. Rep. N. Y. State Geol., 1883, pl. 38, figs. 1-5.

Strophomena minnesotensis N. H. Winchell, Ninth Ann. Rep. Geol. Nat. Hist. Survey Minnesota, 1881, p. 120.

Rafinesquina minnesotensis Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 283.—Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 401, pl. 31, figs. 25-29.

Loc. Minneapolis, etc., Minnesota; Beloit, Wisconsin; Decorah and McGregor, Iowa; central Kentucky; Lebanon, Tennessee.

Obs. This species is probably not identical with R. incrassata (Hall) of the Chazy terrane.

Rafinesquina minnesotaensis inquassa (Sardeson). Trenton (Ord.).

Strophomena inquassa Sardeson, Bull. Minnesota Acad. Nat. Sci., III, 1892, p. 334, pl. 5, figs. 22-24.

Rafinesquina minnesotensis var. inquassa Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 403, pl. 31, figs. 27, 28.

Loc. Minneapolis and St. Paul, Minnesota; Mineralpoint, Wisconsin.

Rafinesquina nitens (Billings). Lorraine (Ord.).

Strophomena nitens Billings, Canadian Nat. Geol., V, 1860, p. 53, fig. 1;—Pal. Fossils, I, 1862, p. 118, fig. 97;—Geol. Canada, 1863, p. 209, fig. 208.

Rafinesquina nitens Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 283.

Loc. Anticosti.

Rafinesquina (?) obscura Hall. Clinton (Sil.).

Leptæna obscura Hall, Pal. New York, II, 1852, pp. 62, 103, pl. 21, figs. 2, 6.

Strophomena obscura Hall, Twelfth Rep. N. Y. State Cab. Nat. Hist., 1859, p. 82.

Strophomena obscura? Foerste, Proc. Boston Soc. Nat. Hist., XXIV, 1890, p. 306, pl. 6, figs. 15, 16.

Rafinesquina ? obscura Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 283.

Loc. Near *Utica and Kirkland,* New York; Cumberland Gap, Tennessee.

Rafinesquina squamula (James). Lorraine (Ord.).

Strophomena squamula James, Cincinnati Quart. Jour Sci., I, 1874, p. 335.
Rafinesquina squamula Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 283.
Loc. Cincinnati, Ohio.

Rafinesquina tenuilineata (Conrad). Trenton (Ord.).

Strophomena tenuilineata Conrad, Jour. Acad. Nat. Sci. Philadelphia, VIII, 1842, p. 259.—Hall, Twelfth Rep. New York State Cab. Nat. Hist., 1859, p. 70.
Leptæna tenuilineata Hall, Pal. New York, I, 1847, p. 115, pl. 31B, fig. 8.
Loc. "Occurs in Trenton limestone."

Rafinesquina ulrichi (James). Utica (Ord.).

Strophomena (?) ulrichi James, The Palæontologist, 1, 1878, p. 6.
Rafinesquina ulrichi Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 283, pl. 15A, figs. 37, 38.
Loc. Cincinnati, Ohio.

RENSSELÆRIA Hall. Genotype Terebratula ovoides Eaton.

Rensselæria Hall, Twelfth Rep. N. Y. State Cab. Nat. Hist., 1859, p. 39;—Pal. New York, III, 1859, p. 454.—Dall, American Jour. Conchology, VI, 1870, p. 105.—Claypole, Proc. American Philosophical Soc., 1883, p. 235.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 255;—Thirteenth Ann. Rep. N. Y. State Geologist, 1895, p. 849.

Rensselæria æquiradiata (Conrad). Lower Helderberg (Dev.).

Atrypa æquiradiata Conrad, Jour. Acad. Nat. Sci. Philadelphia, VIII, 1842, p. 266, pl. 16, fig. 17.
Meganteris æquiradiata Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 99, figs. 1–3.
Rensselæria æquiradiata Hall, Pal. New York, III, 1859, p. 255, pl. 45, fig. 3.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 258, pl. 76, figs. 23–25.
Loc. Cherry Valley, Schoharie, and Carlisle, New York; Arisaig, Nova Scotia (Ami).

Rensselæria cayuga Hall and Clarke. Oriskany (Dev.)

Rensselæria cayuga Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pp. 258–370, pl. 75, figs. 1, 2.
Loc. Cayuga, Ontario.

Rensselæria condoni McChesney=Megalanteris condoni.

Rensselæria cumberlandiæ Hall. Oriskany (Dev.).

Meganteris cumberlandiæ Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 101.
Rensselæria cumberlandiæ Hall, Pal. New York, III, 1859, p. 464, pl. 108, fig. 1.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 258, pl. 77, figs. 23–25.
Loc. Cumberland, Maryland.

Rensselæria elliptica Hall. Lower Helderberg (Dev.).

Meganteris elliptica Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 98.
Rensselæria elliptica Hall, Pal. New York, III, 1859, p. 256, pl. 45, fig. 4.—Hall and Clarke, Ibidem, VIII, Pt. II, 1893, p. 258, pl. 76, figs. 26–28.
Loc. Schoharie County, New York.

Rensselæria elongata Hall=Amphigenia elongata.

Rensselæria intermedia Hall. Oriskany (Dev.).

Rensselæria intermedia Hall, Pal. New York, III, 1859, p. 463, pl. 108, fig. 2.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 77, figs. 26–28.
Loc. Cumberland, Maryland.

Rensselæria johanni Hall=Newberrya johannis.

Rensselæria lævis Hall=Meristella lævis.

Rensselæria lævis Meek=Newberrya lævis.

Rensselæria marylandica Claypole=Newberrya claypolei.

Rensselæria marylandica Hall. Oriskany (Dev.).

Rensselæria marylandica Hall, Pal. New York, III, 1859, p. 461, pl. 108, fig. 3.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 258, pl. 76, figs. 8–20.

Loc. Cumberland, Maryland.

Rensselæria mutabilis Hall. Lower Helderberg (Dev.).

Meganteris mutabilis Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 97.

Rensselæria mutabilis Hall, Pal. New York, III, 1859, p. 254, pl. 45, fig. 2.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pp. 258, 259, figs. 178, 179; pl. 76, figs. 1–3a, 21, 22.

Loc. Albany and Columbia counties, New York.

Rensselæria ovalis Hall=Megalanteris ovalis.

Rensselæria ovoides (Eaton). Oriskany (Dev.).

Terebratula ovoides Eaton, Geological Text-Book, 1832, p. 45.

Terebratula perovalis Eaton, Ibidem, 1832, p. 45.

Atrypa elongata Conrad, Third Ann. Rep. N. Y. Geol. Survey, 1839, p. 65.—Vanuxem, Geol. N. Y.; Rep. Third Dist., 1842, p. 123, fig. 2.—Hall, Ibidem, Fourth Dist., 1843, p. 138, fig. 2;—(Conrad) Fifteenth Rep. N. Y. State Cab. Nat. Hist., 1862, pl. 11, fig. 14.

Pentamerus deshayesii Castelnau, Essai Système Silurien l'Amérique Septentrionale, 1843, p. 38, pl. 15, figs. 1, 2.

Meganteris ovoides Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 102.—Rogers, Geol. Pennsylvania, II, Pt. II, 1858, p. 826, fig. 649.

Rensselæria ovoides Hall, Pal. New York, III, 1859, p. 456, pl. 104, figs. 1–4; pl. 105, figs. 1–6.—Billings, Geol. Canada, 1863, p. 961, fig. 470;—Pal. Fossils, II, 1874, p. 41, pl. 3, figs. 7, 10.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 258, pl. 75, figs. 5–9; pl. 76, figs. 16, 18.

Loc. New York; Pennsylvania; Maryland; Virginia; Gaspé, Canada.

Rensselæria ovulum Hall and Clarke. Oriskany (Dev.).

Rensselæria ovulum Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 75, figs. 3, 4.

Loc. Cayuga, Canada.

Rensselæria portlandica Billings=Trigeria portlandica.

Rensselæria suessana Hall=Beachia suessana.

Rensselandia Hall=Newberrya.

RETICULARIA McCoy. Genotype Terebratula ? imbricata Sowerby.

Reticularia McCoy, Carboniferous Fossils of Ireland, 1844, p. 142.—Waagen, Palæontologica Indica, Ser. XIII, I, 1883, p. 538.

Reticularia bicostata (Vanuxem). Niagara (Sil.).

Orthis bicostatus Vanuxem, Geol. N. Y.; Rep. Third Dist., 1842, pp. 91, 94.

Spirifer bicostatus Hall, Pal. New York, II, 1852, p. 263, pl. 54, fig. 4.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pp. 19, 37, pl. 36, fig. 7.

Spirifera bicostata Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 61, fig. 7.

Loc. Vernon Center, New York; Louisville, Kentucky.

Reticularia bicostata petila (Hall). Niagara (Sil.).

Spirifera bicostata? var. petila Hall, Descrip. n. sp. of Fossils from Waldron, Indiana, 1879, p. 15.

Spirifera bicostata var. petila Hall, Eleventh Rep. State Geol. Indiana, 1882, p. 279, pl. 27, figs. 8, 9;—Trans. Albany Institute, X, 1883, p. 71.

Reticularia bicostata petila (Hall)—Continued.

Spirifer bicostatus var. petilus Beecher and Clarke, Mem. N. Y. State Mus., I, 1889, p. 75, pl. 6, figs. 1–3.

Loc. Waldron, Indiana.

Reticularia canandaiguæ (Hall and Clarke). Hamilton (Dev.).

Spirifer canandaiguæ Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, p. 360, pl. 37, figs. 23–25.

Loc. Centerfield and Canandaigua Lake, New York.

Reticularia clara (Swallow). Kaskaskia (L. Carb.).

Spirifera clara Swallow, Trans. St. Louis Acad. Sci., II, 1863, p. 86.

Loc. St. Genevieve County, Missouri.

Reticularia cooperensis (Swallow). Kinderhook (L. Carb.).

Spirifera cooperensis Swallow, Trans. St. Louis Acad. Sci., I, 1860, p. 643.—Meek and Worthen, Geol. Survey Illinois, II, 1866, p. 155, pl. 14, fig. 5.—Keyes, Geol. Survey Missouri, V, 1895, p. 78.

Spirifer hirtus White and Whitfield, Proc. Boston Soc. Nat. Hist., VIII, 1862, p. 293.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pp. 21, 37, pl. 38, fig. 14 (? pl. 84, figs. 36, 37).

Spirifera semiplicata Hall, Thirteenth Rep. N. Y. State Cab. Nat. Hist., 1863, p. 111.

Spirifer hirtus ? A. Winchell, Proc. Acad. Nat. Sci. Philadelphia, 1865, p. 119;—Proc. American Phil. Soc., XII, 1870, p. 251.

Loc. Chouteau Springs, etc., Missouri; Rockford, Indiana; Burlington, Iowa; Hickman County, Tennessee.

Reticularia fimbriata (Conrad). Oriskany-Ithaca (Dev.).

Delthyris fimbriatus Conrad, Jour. Acad. Nat. Sci. Philadelphia, VIII, 1842, p. 263.—Hall, Geol. N. Y.; Rep. Fourth Dist., 1843, p. 208, fig. 10.

Spirifer fimbriatus Hall, Geol. Survey Iowa, I, Pt. II, 1858, p. 505, pl. 4, fig. 5.—Billings, Canadian Jour., VI, 1861, p. 257, figs. 68–70;—Geol. Canada, 1863, p. 372, fig. 393.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pp. 17, 20, 21, 33, 37, pl. 36, figs. 17–22; pl. 38, figs. 9, 10.

Spirifera fimbriata Hall, Pal. New York, IV, 1867, p. 214, pl. 33, figs. 1–11;—Second Ann. Rep. N. Y. State Geol., 1883, pl. 61, figs. 17–22.—Whiteaves, Cont. Canadian Pal., I, 1892, p. 286.

Spirifer compactus Meek, Trans. Chicago Acad. Sci., I, 1868, p. 102, pl. 14, fig. 11.

Spirifer (Martinia) richardsoni Meek, Trans. Chicago Acad. Sci., I, 1868, p. 104, pl. 14, fig. 2.

Spirifera (M.) richardsoni Whiteaves, Cont. Canadian Pal., I, 1891, p. 226;—Ibidem, 1892, p. 287, pl. 37, fig. 7.

Spirifera conradana Miller, American Pal. Foss., 2d ed., 1883, p. 372.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 110, pl. 7, figs. 11–13.

Spirifera (M.) undifera Walcott, Mon. U. S. Geol. Survey, VIII, 1884, pl. 3, figs. 3, 6; pl. 14, fig. 11.

Loc. New York; Ohio; Falls of Ohio; Illinois; Iowa; Maryland; Virginia; Eureka district, Nevada; Ontario and lakes Manitoba and Winnipegosis; Mackenzie River, Northwest Territory, Canada.

Obs. Mr. Walcott is correct in regarding this species the same as Spirifer undiferus Roemer. Conrad's species, however, was published in 1842, while that of Roemer is two years later, or in 1844. S. richardsoni is a young specimen of S. compacta which Mr. Walcott has shown to be a synonym for S. undiferus. See Reticularia knappiana.

Reticularia franklini (Meek). Hamilton (Dev.).

Spirifer (Martinia) franklini Meek, Trans. Chicago Acad. Sci., I, 1868, p. 107, pl. 14, fig. 12.

Spirifera (M.) glabra var. franklini Whiteaves, Cont. Canadian Pal., I, 1891, p. 225.

Loc. Mackenzie River, Northwest Territory, Canada.

Obs. The type specimen in the U. S. National Museum collection proves to be closely related to Reticularia lævis Hall.

Reticularia guadalupensis (Shumard). Upper Carboniferous.

Spirifera guadalupensis Shumard, Trans. St. Louis Acad. Sci., I, 1859, p. 391.

Loc. Guadalupe Mountains, Texas.

Reticularia knappiana (Nettelroth). Corniferous (Dev.).

Spirifera knappiana Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 122, pl. 7, fig. 14.

Loc. Falls of Ohio.

Obs. Probably the same as R. fimbriata.

Reticularia lævis (Hall). Portage (Dev.).

Delthyris lævis Hall, Geol. N. Y.; Rep. Fourth Dist., 1843, p. 245, fig. 1.

Spirifera lævis Hall, Pal. New York, IV, 1867, p. 239, pl. 39, figs. 1–12.

Spirifer lævis Williams, American Jour. Sci., 3d ser., XX, 1880, p. 456.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pp. 19, 33, 37, pl. 38, figs. 11–13; pl. 84, fig. 29.—Kindle, Bull. American Pal., 6, 1896, p. 36.

Spirifera (Martinia) glabra var. lævis Williams, Ann. New York Acad. Sci., II, 6, 1881, pl. 14, figs. 1, 2.—Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 140.

Loc. Ithaca and Cortlandville, New York.

Reticularia modesta (Hall). Lower Helderberg (Dev.).

Spirifer modestus Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 61;—Pal. New York, III, 1859, p. 203, pl. 28, fig. 1.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 37, pl. 38, figs. 1, 3.

Loc. Cumberland, Maryland.

Reticularia nevadaensis (Walcott). Upper Devonian.

Spirifera (M.) glabra var. nevadensis Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 139, pl. 3, fig. 5; pl. 14, fig. 14.

Loc. Eureka district, Nevada.

Reticularia (?) nympha (Billings). Lower Helderberg (Dev.).

Spirifera nympha Billings, Proc. Portland Soc. Nat. Hist., I, 1863, p. 116, pl. 3, fig. 15.

Loc. Masardis, Maine.

Reticularia perplexa (McChesney). Upper Carboniferous.

Spirifer lineatus Shumard, Geol. Survey Missouri, 1855, p. 216.—Hall, Pacific R. R. Reports, III, 1856, p. 101, pl. 2, figs. 6–8.—Marcou, Geol. N. America, 1858, p. 50, pl. 7, fig. 5.—Newberry, Ives's Rep. Colorado River of the West, 1861, p. 127.—Swallow, Trans. St. Louis Acad. Sci., II, 1866, p. 408.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pp. 10, 11, 17, 21, 30, 39, pl. 38, figs. 2, 4, 7, 8.

Spirifer perplexus McChesney, New Pal. Fossils, 1860, p. 43.

Spirifer lineatus? Meek, Geol. Survey California, I, 1864, p. 13, pl. 2, fig. 6.

Spirifer lineatus var. perplexus Swallow, Trans. St. Louis Acad. Sci., II, 1866, p. 408.

Spirifera lineata Meek, Final Rep. U. S. Geol. Survey Nebraska, 1872, pl. 2, fig. 3.—Keyes, Proc. Acad. Nat. Sci. Philadelphia, 1888, p. 230.

Spirifer (Martinia) perplexa Derby, Bull. Cornell Univ., I, 1874, p. 16, pl. 3, figs. 27, 39, 40, 45, 50; pl. 8, fig. 13.

Reticularia perplexa (McChesney)—Continued.

Spirifera (Martinia) lineata? White, Wheeler's Expl. and Survey west 100th Meridian, III, Appendix, 1881.

Spirifera (Martinia) lineata White, Eleventh Rep. State Geol. Indiana, 1882, p. 372, pl. 42, figs. 4–6;—Thirteenth Rep. State Geol. Indiana, 1884, p. 133, pl. 27, figs. 4–6.—Herrick, Bull. Denison Univ., II, 1887, p. 46, pl. 1, fig. 13.—Whitfield, Annals N. Y. Acad. Sci., V, 1891, p. 603, pl. 16, figs. 3–5;—Geol. Ohio, VII, 1895, p. 488, pl. 12, figs. 3–5.

Spirifera perplexa Keyes, Geol. Survey Missouri, V, 1895, p. 84.

Loc. Ohio; Indiana; Illinois; Missouri; Iowa; Kentucky; California; Texas; Pecos and Tigeras, New Mexico; Shasta County, California; Bomjardim and Itaituba, Brazil.

Obs. This species is not identical with Reticularia lineata Martin, as found in England and Belgium. Reticularia pseudolineata (Hall) is more closely allied to that species than R. perplexa (McChesney).

Reticularia perplexa striatilineata (Swallow). Upper Carboniferous.

Spirifer lineatus var. striatolineatus Swallow, Trans. St. Louis Acad. Sci., II, 1866, p. 408.

Loc. Missouri.

Obs. Regarded by Keyes as a synonym for R. perplexa.

Reticularia præmatura (Hall). Chemung (Dev.).

Spirifera præmatura Hall, Proc. American Philosophical Soc., X, 1866, p. 246;—Pal. New York, IV, 1867, p. 250, pl. 33, figs. 31–35;—Second Ann. Rep. N. Y. State Geol., 1883, pl. 61, figs. 23–25.

Martinia prematura Herrick, Geol. Ohio, VII, 1895, pl. 23, fig. 12.

Spirifer præmaturus Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 37, pl. 36, figs. 23–25.

Loc. Meadville and Oil Creek, Pennsylvania.

Reticularia pseudolineata (Hall). Burlington-Keokuk (L. Carb.).

Spirifer pseudolineatus Hall, Geol. Survey Iowa, I, Pt. II, 1858, p. 645, pl. 20, fig. 4.—?Herrick, Bull. Geol. Soc. America, II, 1891, p. 45, pl. 1, fig. 18.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pp. 21, 37, pl. 36, figs. 28–30.

Spirifera lineatoides Swallow, Trans. St. Louis Acad. Sci., I, 1860, p. 645.

Spirifera pseudolineata Safford, Geol. Tennessee, 1869, p. 360.—Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 61, figs. 28–30.

Reticularia pseudolineata Waagen, Palæontologica Indica, Ser. XIII, I, 1883, p. 542.

Spirifera lineatoides and pseudolineata Keyes, Geol. Survey Missouri, V, 1895, pp. 81, 82, pl. 40, fig. 6.

Loc. Keokuk, Iowa; Warsaw, Illinois; Crawfordsville, Indiana; Missouri.

Obs. See R. perplexa (McChesney).

Reticularia setigera (Hall). Kaskaskia (L. Carb.).

Spirifer setigerus Hall, Geol. Survey Iowa, I, Pt. II, 1858, p. 705, pl. 27, fig. 4.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pp. 21, 37, pl. 36, figs. 26, 27.

Spirifera setigera Hall and Whitfield, King's U. S. Geol. Expl. 40th Parl., IV, 1877, p. 270, pl. 5, figs. 17, 18.—Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 61, figs. 26, 27.—Keyes, Geol. Survey Missouri, V, 1895, p. 83.

Reticularia setigera Waagen, Palæontologica Indica, Ser. XIII, I, 1883, p. 542.

Loc. Kaskaskia and Chester, Illinois; Caldwell and Crittenden counties, Kentucky; Oquirrh Mountains, Utah.

Obs. See R. translata.

Reticularia subundifera (Meek and Worthen). Hamilton (Dev.).

Spirifera subundifera Meek and Worthen, Geol. Survey Illinois, III, 1868, p. 434, *pl. 10, fig. 5.*

ticularia subundifera (Meek and Worthen)—Continued.

Spirifera (M.) undifera var. subundifera Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 145.

Loc. Rock Island, Illinois.

ticularia (?) temeraria (Miller). Lower Carboniferous.

Spirifera temeraria Miller, Jour. Cincinnati Soc. Nat. Hist., IV, 1881, p. 314, pl. 7, fig. 9.

Loc. Lake Valley mining district, New Mexico.

ticularia tenuispinata (Herrick). Waverly (L. Carb.).

Spirifera (Martinia) tenuispinata Herrick, Bull. Denison Univ., IV, 1888, p. 27, pl. 2, fig. 4.

Spirifer tenuispinatus Herrick, Geol. Ohio, VII, 1895, pl. 15, fig. 4.

Loc. Granville, Ohio.

ticularia translata (Swallow). Kaskaskia (L. Carb.).

Spirifera translata Swallow, Trans. St. Louis Acad. Sci., II, 1863, p. 85.

Loc. Chester, Illinois; St. Marys, Missouri.

Obs. Regarded by Keyes as a synonym for R. setigera.

ETZIA King. Genotype Terebratula adrieni de Verneuil.

Retzia King, Mon. Permian Fossils, Pal. Soc., 1850, p. 137.—Hall, Sixteenth Rep. N. Y. State Cab. Nat. Hist., 1863, p. 53, figs. 1-3 on p. 55.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 103, figs. 80-100 on pp. 106, 107;—Thirteenth Ann. Rep. N. Y. State Geologist, 1895, p. 787.

Obs. It is very probable that all of the species here referred to Retzia will prove to belong to other genera.

etzia altirostris White=Eumetria altirostris.

etzia chloe Billings=Parazyga hirsuta.

etzia (?) circularis Miller. Chouteau (L. Carb.).

Retzia circularis Miller, Eighteenth Ann. Rep. Geol. Survey Indiana, 1894, p. 316, pl. 9, figs. 32-34.

Loc. Sedalia, Missouri.

etzia compressa Meek=Hustedia mormoni.

etzia dubia Billings=Trematospira dubia.

etzia electra Billings=Rhynchospira electra.

etzia eugenia Billings=Rhynchospira eugenia.

etzia evax Hall=Homœospira evax.

etzia formosa Whitfield=Rhynchospira formosa.

etzia (?) granulifera Meek. Lorraine (Ord.).

Retzia (Trematospira) granulifera Meek, Proc. Acad. Nat. Sci. Philadelphia, 1872, p. 318;—Pal. Ohio, I, 1873, p. 128, pl. 11, fig. 6.

Trematospira (?) granulifera Miller, Cincinnati Quart. Jour. Sci., II, 1875, p. 61.

Loc. Cincinnati, Ohio.

Obs. This species is probably a rhynchonelloid.

etzia hippolyte Billings=Trematospira hippolyte.

etzia (?) jamesiana Rathbun. Middle Devonian.

Retzia jamesiana (Hartt) Rathbun, Bull. Buffalo Soc. Nat. Hist., I, 1874, p. 243, pl. 10, figs. 23, 27-38.

Retzia ? jamesiana Derby, Archives do Museu Nacional do Rio de Janeiro, IX, 1890, p. 79.

Retzia cf. jamesiana A. Ulrich, N. Jahrb. f. Mineral., Beilageband, VIII, 1892, p. 68, pl. 4, fig. 14.

Loc. Erere and Rio Maecuru, Province of Para, Brazil; Bolivia.

Retzia marcyi Shumard=Eumetria marcyi.
Retzia meekana Shumard=Hustedia meekana.
Retzia mormoni Marcou=Hustedia mormoni.
Retzia osagensis Swallow=Acambona osagensis.
Retzia papillata Shumard=Hustedia papillata.

Retzia (?) plicata Miller. Chouteau (L. Carb.).
Retzia plicata Miller, Eighteenth Ann. Rep. Geol. Survey Indiana, 1894, p. 316, pl. 9, figs. 29–31.
Loc. Sedalia, Missouri.

Retzia polypleura A. Winchell. Portage (Dev.).
Retzia polypleura A. Winchell, Proc. Acad. Nat. Sci. Philadelphia, 1862, p. 406.
Loc. Port aux Barques, Michigan.

Retzia (?) popeana Swallow. ? Chouteau (L. Carb.).
Retzia (?) popeana Swallow, Trans. St. Louis Acad. Sci., I, 1860, p. 654.
Loc. Locality and formation not given.

Retzia punctulifera Shumard=Hustedia mormoni.
Retzia radialis Walcott (non Phillips)=Hustedia mormoni.
Retzia sexplicata White and Whitfield=Ptychospira sexplicata.
Retzia sobrina Beecher and Clarke=Homœospira sobrina.

Retzia (?) subglobosa Hall. Schoharie (Dev.).
Rhynchospira subglobosa Hall, Pal. New York, IV, 1867, p. 421, pl. 63, figs. 23–25.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 49, fig. 22.
Retzia subglobosa Miller, N. American Geol. and Pal., 1889, p. 367.
Loc. Schoharie, New York.

Retzia subglobosa McChesney=Hustedia mormoni.
Retzia triangularis Miller=Hustedia triangularis.
Retzia vera Hall=Eumetria marcyi.
Retzia vera costata Hall=Eumetria marcyi costata.
Retzia verneuiliana Hall=Eumetria marcyi.
Retzia ? wardiana Rathbun=Trigeria wardiana.
Retzia woosteri White=Eumetria woosteri.

RHINOBOLUS Hall. Genot. Rhynobolus sp. H.=?**Obolus galtensis** Bill.
Rhynobolus Hall, Notes on some New or Imperfectly Known Forms among the Brachiopoda, 1871, p. 5;—Ibidem, 1872, p. 5, pl. 13, fig. 10;—Twenty-third Rep. N. Y. State Cab. Nat. Hist., 1873, p. 247, pl. 13, fig. 10.—Waagen, Palæontologica Indica, Ser. XIII, I, 1885, p. 761.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 44, 46, 164;—Eleventh Ann. Rep. N. Y. State Geologist, 1894, p. 239.

Rhinobolus davidsoni Hall and Clarke. Niagara (Sil.).
Rhinobolus davidsoni Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 45, 176, pl. 4B, figs. 10–12.
Loc. Near Grafton, Wisconsin.

Rhinobolus galtensis (Billings). Guelph (Sil.).
Obolus galtensis Billings, Pal. Fossils, I, 1862, p. 168, fig. 153.
Obolellina galtensis Billings, Canadian Nat. Geol., VI, 1871, p. 222;—Ibidem, 1872, p. 328.
Trimerella minor Dall, American Jour. Conch., VII, 1871, p. 83, pl. 11, fig. 6.
?Rhynobolus sp.? Hall, Twenty-third Rep. N. Y. State Cab. Nat. Hist., 1873, *p. 247, pl. 13,* fig. 10.

Rhinobolus galtensis (Billings)—Continued.

Trimerella (?) galtensis Davidson and King, Quart. Jour. Geol. Soc. London, XXX, 1874, p. 151, pl. 18, fig. 13; pl. 19, fig. 4.

Rhynobolus galtensis Whiteaves, Pal. Fossils, III, 1884, p. 7, pl. 2, fig. 1; pl. 8, fig. 3.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 45, pl. 4B, figs. 7-9.

Loc. Galt, Elora, Hespelar, and Durham, Ontario.

RHIPIDOMELLA Œhlert. Genotype Terebratula michelini L'Éveillé.

Rhipidomys Œhlert (non Wagnor, 1844), Fischer's Manuel de Conchyliologie, 1887, p. 1288.—Hall, Bull. Geol. Soc. America, I, 1889, p. 21.

Rhipidomella Œhlert, Journal de Conchyliologie, 1891, p. 372.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 209;—Eleventh Ann. Rep. N. Y. State Geologist, 1894, p. 271.

Rhipidomella alsa Hall. Schoharie (Dev.).

Orthis alsus Hall, Sixteenth Rep. N. Y. State Cab. Nat. Hist., 1863, p. 33;—Pal. New York, IV, 1867, p. 36, pl. 4, figs. 2-7.

Rhipidomella alsa Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 225.

Loc. Albany County, New York.

Obs. Probably a synonym for R. peloris Hall.

Rhipidomella assimilis Hall. Lower Helderberg (Dev.).

Orthis assimilis Hall, Pal. New York, III, 1859, p. 175, pl. 15, fig. 1.

Rhipidomella assimilis Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 224.

Loc. Schoharie, New York.

Rhipidomella burlingtonensis Hall. Burlington (L. Carb.).

Orthis michelini var. burlingtonensis Hall, Geol. Survey Iowa, I, Pt. II, 1858, p. 596, pl. 12, fig. 4.

Rhipidomella burlingtonensis Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 225, pl. 6A, fig. 13; pl. 20, figs. 5, 6.

Orthis burlingtonensis Keyes, Geol. Survey Missouri, V, 1895, p. 63, pl. 38, fig. 7.

Loc. Burlington, Iowa; Quincy, Illinois; Hannibal, Missouri.

Rhipidomella circulus Hall. Clinton (Sil.).

Orthis circulus Hall, Geol. N. Y.; Rep. Fourth Dist., 1843, p. 71, fig. 1;—Pal. New York, II, 1852, p. 56, pl. 20, fig. 6.—Billings, Canadian Nat. Geol., I, 1856, p. 134, pl. 2, fig. 1.

Rhipidomella circulus Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 210, 224, pl. 6A, figs. 1, 2.

Loc. Reynales Basin, New York; Hamilton, Ontario.

Rhipidomella clarkensis (Swallow). Keokuk (L. Carb.).

Orthis clarkensis Swallow, Trans. St. Louis Acad. Sci., II, 1863, p. 81.

Rhipidomella clarkensis Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 225.

Loc. Clark County, Missouri.

Obs. Keyes regards this species as a synonym for Schizophoria swallovi.

Rhipidomella cleobis Hall. Onondaga (Dev.).

Orthis cleobis Hall, Sixteenth Rep. N. Y. State Cab. Nat. Hist., 1863, p. 35;—Pal. New York, IV, 1867, p. 41, pl. 5, figs. 9, 10.

Rhipidomella cleobis Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 225.

Loc. Williamsville and Clarence, New York.

Rhipidomella cumberlandiæ Hall. Oriskany (Dev.).

Orthis cumberlandiæ Hall, Pal. New York, III, 1859, p. 481, pl. 95A, figs. 20, 21.

Rhipidomella cumberlandiæ Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 225.

Loc. Cumberland, Maryland.

Rhipidomella (?) cuneata (Owen). Hamilton (Dev.).

Orthis cuneata Owen, Geol. Survey Wisconsin, Iowa, and Minnesota, 1852, p. 585, pl. 3A, fig. 10.

Rhipidomella cuneata Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 225.

Loc. New Buffalo, Iowa

Rhipidomella cyclas Hall. Marcellus and Hamilton (Dev.).

Orthis cyclas Hall, Thirteenth Rep. N. Y. State Cab. Nat. Hist., 1860, p. 78;—Pal. New York, IV, 1867, p. 52, pl. 7, figs. 2, 3.

Rhipidomella cyclas Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 225.

Loc. York, Pavilion, Bellona, etc., New York.

Rhipidomella dalyana (Miller). Burlington (L. Carb.).

Orthis dalyana Miller, Jour. Cincinnati Soc. Nat. Hist., IV, 1881, p. 313, pl. 7, fig. 8.

Rhipidomella dalyana Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 225.

Loc. Lake Valley mining district, New Mexico.

Rhipidomella discus Hall. Lower Helderberg (Dev.).

Orthis discus Hall, Pal. New York, III, 1859, p. 165, pl. 10A, figs. 7–12.

Rhipidomella discus Hall and Clarke, Ibidem, VIII, Pt. I, 1892, pp. 210, 225.

Loc. Hudson, Catskill, etc., New York; Square Lake, Maine.

Rhipidomella dubia Hall. St. Louis (L. Carb.).

Orthis dubius Hall, Trans. Albany Institute, IV, 1858, p. 12.—Whitfield, Bull. American Mus. Nat. Hist., I, 1882, p. 45, pl. 6, figs. 1–5.—Hall, Twelfth Rep. State Geol. Indiana, 1883, p. 324, pl. 29, figs. 1–5.

Orthis cooperensis Swallow, Trans. St. Louis Acad. Sci., II, 1863, p. 82.

Rhipidomella dubia Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 210, 225, pl. 6A, figs. 18–22.

Orthis dubia Keyes, Geol. Survey Missouri, V, 1895, p. 64.

Loc. Spergen Hill and Bloomington, Indiana; Alton, Appanoose, etc., Illinois; Boonville and Barretts Station, Missouri; Keokuk, Iowa; Caldwell County, Kentucky.

Obs. Typical examples of R. cooperensis have been studied in Professor Hall's collection.

Rhipidomella eminens Hall. Lower Helderberg (Dev.).

Orthis eminens Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 42, figs. 1, 2;—Pal. New York, III, 1859, p. 167, pl. 11, figs. 7–14.

Rhipidomella eminens Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 210, 225.

Loc. Schoharie, Carlisle, etc., New York.

Rhipidomella goodwini (Nettelroth). Hamilton (Dev.).

Orthis goodwini Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 39, pl. 17, figs. 30–32.

Loc. Falls of Ohio.

Rhipidomella hartti (Rathbun). Middle Devonian.

Orthis hartti Rathbun, Proc. Boston Soc. Nat. Hist., XX, 1879, p. 23.

Loc. Province of Para, Brazil.

Rhipidomella hybrida (Sowerby). Niagara (Sil.).

Orthis hybrida Sowerby, Murchison's Silurian System, 1839, p. 630, pl. 13, fig. 11.—Hall, Geol. N. Y.; Rep. Fourth Dist., 1843, p. 105, fig. 7;—Pal. New York, II, 1852, p. 253, pl. 52, fig. 4.—Roemer, Die Silurische Fauna des West. Tennessee, 1860, p. 63, pl. 5, fig. 6.—Meek and Worthen, Geol. Survey Illinois, 1868, p. 371, pl. 7, fig. 7.—Hall, Twenty-eighth Rep. N. Y. State Mus. Nat. Hist., 1879, p. 149, pl. 21, figs. 18–25;—Eleventh Rep. State Geol. Indiana, 1882, p. 285, pl. 21, figs. 18–25;—Second Ann. Rep. N. Y. State Geol., 1883, pl. 36,

Rhipidomella hybrida (Sowerby)—Continued.

figs. 1–5.—Foerste, Bull. Denison Univ., I, 1885, p. 83, pl. 13, fig. 10.—Beecher and Clarke, Mem. N. Y. State Mus., I, 1889, p. 17, pl. 1, figs. 13–18.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 39, pl. 32, figs. 32–35.

Orthis hybrida? Hall, Trans. Albany Institute, IV, 1863, p. 209.

Rhipidomella hybrida Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 210, 224, pl. 6, figs. 1–5.

Orthis (Rhipidomella) hybrida Foerste, Geol. Ohio, VII, 1895, p. 584, pl. 25, fig. 10.

Loc. Europe; Lockport, etc., New York; Waldron, Indiana; Dayton, Ohio; Louisville, Kentucky; Perry County, Tennessee; Perry County, Missouri; Arisaig, Nova Scotia (Ami).

Rhipidomella idonea Hall. Hamilton (Dev.).

Orthis idonea Hall, Pal. New York, IV, 1867, p. 52, pl. 63, figs. 1–5.

Rhipidomella idonea Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 225.

Loc. Moscow and Eighteen Mile Creek, New York.

Rhipidomella inca (d'Orbigny). Devonian.

Orthis inca d'Orbigny, Voyage dans l'Amérique Méridionale, Pal., 1842, p. 38.

Spirifer inca d'Orbigny, Ibidem, 1842, pl. 2, figs. 10–12.

Loc. Cochabamba, Bolivia.

Rhipidomella leucosia Hall. Hamilton (Dev.).

Orthis leucosia Hall, Thirteenth Rep. N. Y. State Cab. Nat. Hist., 1860, p. 80;—Pal. New York, IV, 1867, pp. 48, 63, pl. 7, fig. 4; pl. 8, figs. 9, 10;—Second Ann. Rep. N. Y. State Geol., 1883, pl. 36, fig. 16.

Rhipidomella leucosia Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 225, pl. 6, fig. 16; pl. 6A, fig. 9.

Loc. Eighteen Mile Creek, Canandaigua Lake, etc., New York; Cumberland, Maryland.

Rhipidomella livia (Billings). Corniferous (Dev.).

Orthis livia Billings, Canadian Journal, n. ser., V, 1860, p. 267, figs. 14–16;—Geol. Canada, 1863, p. 369, fig. 385.—Hall, Pal. New York, IV, 1867, p. 38, pl. 5, fig. 4.—Billings, Pal. Fossils, II, 1874, p. 32, figs. 14–16.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 40, pl. 16, figs. 23, 24; pl. 17, figs. 33–35.

Rhipidomella livia Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 225.

Loc. Walpole, Ontario; New York; Columbus, Ohio; Falls of Ohio; Indian Cove, Gaspé.

Rhipidomella lucia (Billings). Oriskany (Dev.).

Orthis lucia Billings, Pal. Fossils, II, 1874, p. 35, pl. 3, fig. 4.

Rhipidomella lucia Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 225.

Loc. Indian Cove, Gaspé.

Rhipidomella media (Shaler). Anticosti (Sil.).

Orthis media Shaler, Bull. Mus. Comp. Zool., 4, 1865, p. 65.—Billings, Catalogue Silurian Fossils of Anticosti, 1866, p. 41.

Loc. Anticosti.

Rhipidomella michelini (L'Éveillé). Waverly (L. Carb.).

Terebratula michelini L'Éveillé, Mém. Société Géol. de France, II, 1835, p. 39, pl. 2, figs. 14–17.

Orthis michelini Yandell and Shumard, Cont. Geol. Kentucky, 1847, p. 21.—A. Winchell, Proc. Acad. Nat. Sci. Philadelphia, 1865, p. 116.

Orthis michelini? A. Winchell, Proc. American Philosophical Soc., XII, 1870, p. 251.—Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 36, figs. 19–21.

Rhipidomella michelini (L'Éveillé)—Continued.

Rhipidomella michelini Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 194, 225, pl. 6A, fig. 12.

Loc. South of Louisville, and near Lebanon, Kentucky; Newark, Granville, etc., Ohio; Shafers, Pennsylvania; Lake Valley mining district, New Mexico.

Obs. It is probable that the American identifications of this species are the same as R. oweni Hall and Clarke.

Rhipidomella missouriensis (Swallow). Chouteau (L. Carb.).

Orthis missouriensis Swallow (non Shumard, 1855), Trans. St. Louis Acad. Sci., I, 1860, p. 639.

Rhipidomella missouriensis Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 225, pl. 6A, figs. 16, 17.

Loc. Cooper and Marion counties, Missouri.

Rhipidomella (?) mitis (Hall). Schoharie (Dev.).

Orthis mitis Hall, Sixteenth Rep. N. Y. State Cab. Nat. Hist., 1863, p. 34;—Pal. New York, IV, 1867, p. 37.

Loc. Albany and Schoharie counties, New York.

Rhipidomella musculosa Hall. Oriskany (Dev.).

Orthis musculosa Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 46;—Pal. New York, III, 1859, p. 409, pl. 91, figs. 1–3; pl. 95, figs. 1–7.

Rhipidomella musculosa Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 190, 210, 225, pl. 6A, fig. 5.

Loc. Schoharie and Albany counties, New York; Cumberland, Maryland.

Rhipidomella nevadaensis (Meek). Carboniferous.

Orthis michelini (non L'Éveillé) var. Meek, King's U. S. Geol. Expl. 40th Parl., IV, 1877, p. 63, pl. 7, fig. 1.

Orthis nevadensis Meek, Ibidem, 1877; end of description.

Rhipidomella nevadensis Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 225.

Loc. White Pine district, Nevada.

Rhipidomella oblata Hall. Lower Helderberg (Dev.).

Orthis oblata Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 41, figs. 1–5;—Pal. New York, III, 1859, p. 162, pl. 10, figs. 1–22.—Whitfield, Geol. Wisconsin, IV, 1882, p. 320, pl. 25, figs. 1, 2.

Rhipidomella oblata Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 210, 225, pl. 6A, figs. 3, 4.

Loc. Schoharie, Carlisle, Hudson, etc., New York; Waunakee, Wisconsin.

Rhipidomella oblata emarginata (Hall). Lower Helderberg (Dev.).

Orthis oblata var. emarginata Hall, Pal. New York, III, 1859, p. 164, pl. 10A, figs. 4–6.

Loc. Cumberland, Maryland.

Rhipidomella occasus Hall. Kinderhook (L. Carb.).

Orthis occasus Hall, Thirteenth Rep. N. Y. State Cab. Nat. Hist., 1860, p. 111.

Rhipidomella occasus Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 225.

Loc. Rockford, Indiana.

Obs. Compare with R. thiemei White.

Rhipidomella oweni Hall and Clarke. Waverly (L. Carb.).

Orthis (Rhipidomella) oweni Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 342, pl. 6, figs. 19–21.

Loc. Buttonmould Knobs, south of Louisville, Kentucky.

Obs. See R. michelini L'Éveillé.

Rhipidomella pecosi (Marcou). Upper Carboniferous.

Orthis pecosi Marcou, Geol. N. America, February 1858, p. 48, pl. 6, fig. 14.—White, Wheeler's Expl. Survey west 100th Meridian, IV, 1875, p. 125, pl. 9, fig. 5.—Kayser, Richthofen's China, IV, 1883, p. 177, pl. 24, fig. 1.—Waagen, Palæontologica Indica, Ser. XIII, I, 1884, p. 573, pl. 56, figs. 1–3.—White, Thirteenth Rep. State Geol. Indiana, 1884, p. 129, pl. 32, figs. 20–22.—Keyes, Geol. Survey Missouri, V, 1895, p. 64.—Smith, Proc. American Phil. Soc., XXXV, 1897, p. 27 (extract).

Orthis carbonaria Swallow, Trans. St. Louis Acad. Sci., I, June, 1858, p. 218.—Meek, Final Rep. U. S. Geol. Survey Nebraska, 1872, p. 173, pl. 1, fig. 8.—Meek and Worthen, Geol. Survey Illinois, V, 1873, p. 571, pl. 25, fig. 4.—Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 37, figs. 1–4.

Orthis sp. nudet. Meek, Pal. California, I, 1864, p. 10, pl. 2, fig. 5.

Rhipidomella pecosi Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 210, 226, pl. 7, figs. 1–4.

Loc. Throughout the Upper Carboniferous of North America; Lo-Ping, China; Amb, India.

Rhipidomella peloris Hall. Schoharie (Dev.).

Orthis peloris Hall, Sixteenth Rep. N. Y. State Cab. Nat. Hist., 1863, p. 32;—Pal. New York, IV, 1867, p. 34, pl. 4, figs. 1, 8–10.

Rhipidomella peloris Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 225, pl. 6A, fig. 6.

Loc. Clarksville and Knox, New York.

Obs. Probably the same as R. alsa Hall.

Rhipidomella penelope Hall. Hamilton (Dev.).

Orthis penelope Hall, Thirteenth Rep. N. Y. State Cab. Nat. Hist., 1860, p. 79, figs. 1, 2;—Pal. New York, IV, 1867, p. 50, pl. 6, fig. 2;—Second Ann. Rep. N. Y. State Geol., 1883, pl. 36, figs. 6–13.

Rhipidomella penelope Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 211, 225, pl. 6, figs. 6–13; pl. 6A, fig. 10 (? 11).

Loc. Hamburg, Alexander, Pavilion, York, Moscow, etc., New York.

Rhipidomella penniana (Derby). Upper Carboniferous.

Orthis penniana Derby, Bull. Cornell Univ., I, 1874, p. 26, pl. 5, figs. 13, 15, 17, 19–22; pl. 8, fig. 2.

Rhipidomella penniana Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 210, 225, pl. 7, figs. 5–10.

Loc. Bomjardim and Itaituba, Brazil.

Rhipidomella pennsylvanica (Simpson). Chemung (Dev.).

Orthis pennsylvanica Simpson, Trans. American Philosophical Soc., n. ser., XVI, 1889, p. 437, fig. 1.

Loc. Tioga and McKean counties, Pennsylvania.

Rhipidomella rhynchonelliformis (Shaler). Anticosti (Sil.).

Orthis rhynchonelliformis Shaler, Bull. Mus. Comp. Zool., 4, 1865, p. 66.—Billings, Catalogue Sil. Foss. Anticosti, 1866, p. 42.

Loc. Anticosti.

Obs. Probably a variety of Rhipidomella uberis (Billings).

Rhipidomella semele Hall. Onondaga (Dev.).

Orthis semele Hall, Sixteenth Rep. N. Y. State Cab. Nat. Hist., 1863, p. 34;—Pal. New York, IV, 1867, p. 40, pl. 5, figs. 7, 8.

Rhipidomella semele Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 225.

Loc. Erie County, New York; Columbus, Ohio.

Rhipidomella solitaria Hall. Hamilton (Dev.).

Orthis solitaria Hall, Thirteenth Rep. New York State Cab. Nat. Hist., 1860, p. 80;—Pal. New York, IV, 1867, p. 45, pl. 7, fig. 1.

Rhipidomella solitaria Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 225.

Loc. York, New York.

Rhipidomella subcirculus (Simpson). Clinton (Sil.).

Orthis subcircula Simpson, Trans. American Philosophical Soc., n. ser., XVI, 1889, p. 437, fig. 2.

Loc. Mifflin and Huntington counties, Pennsylvania.

Rhipidomella subelliptica (White and Whitfield). Kinderhook (L. Carb.).

Orthis subelliptica White and Whitfield, Proc. Boston Soc. Nat. Hist., VIII, 1862, p. 292.

Rhipidomella subelliptica Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 225.

Loc. Burlington, Iowa.

Rhipidomella suborbicularis Hall. Hamilton (Dev.).

Orthis suborbicularis Hall, Geol. Survey Iowa, I, Pt. II, 1858, p. 486, pl. 2, fig. 1.

Rhipidomella suborbicularis Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 225.

Loc. Rock Island, Illinois.

Rhipidomella thiemei (White). Chemung (Dev.) and Kinderhook (L. Carb.).

Orthis thiemii, White, Jour. Boston Soc. Nat. Hist., VII, 1860, p. 231;—Twelfth Rep. Hayden's U. S. Geol. Survey Terr., 1883, p. 164, pl. 41, fig. 4.

Orthis thiemii? Hall, Pal. New York, IV, 1867, p. 63, pl. 8, fig. 2.

Rhipidomella thiemii Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 225, pl. 6A, figs. 14, 15.

Loc. Burlington, Iowa; In the Chemung group at Leon, Napoli, and New Albion, New York.

Rhipidomella tubulistriata Hall. Lower Helderberg (Dev.).

Orthis tubulostriata Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 42;—Pal. New York, III, 1859, p. 166, pl. 11, figs. 1–6.

Rhipidomella tubulostriata Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 210, 225.

Loc. Albany County, New York.

Rhipidomella uberis (Billings). Anticosti (Sil.).

Orthis æquivalvis Shaler (non Hall, 1847), Bull. Mus. Comp. Zool., 4, 1865, p. 66.

Orthis uberis Billings, Catalogue Sil. Foss. Anticosti, 1866, p. 42.

Rhipidomella uberis Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 224.

Loc. Anticosti.

Obs. See Rhipidomella rhynchonelliformis (Shaler).

Rhipidomella vanuxemi Hall. Corniferous-Hamilton (Dev.).

Orthis vanuxemi Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 135, figs. 1–7;—Geol. Survey Iowa, I, Pt. II, 1858, p. 487, pl. 2, figs. 2, 3.—Billings, Canadian Jour., V, 1860, p. 269.—A. Winchell, Proc. Acad. Nat. Sci. Philadelphia, 1862, p. 409.—Billings, Geol. Canada, 1863, p. 384, fig. 417.—Hall, Pal. New York, IV, 1867, pp. 40, 47, pl. 5, fig. 6; pl. 6, fig. 3;—Second Ann. Rep. N. Y. State Geol., 1883, pl. 36, figs. 14, 15.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 45, pl. 16, figs. 4–6, 12–14.—Herrick, Geol. Ohio, VII, 1895, pl. 20, fig. 10.

Rhipidomella vanuxemi Hall—Continued.

Rhipidomella vanuxemi Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 225, pl. 6, figs. 14, 15; pl. 6A, figs. 7, 8.

Loc. New York; Columbus, Ohio; Falls of Ohio; Rock Island, Illinois; Buffalo, Iowa; Bosanquet, Ontario; Huron group, Port aux Barques, Michigan.

Rhipidomella vanuxemi pulchella (Herrick.) Waverly (L. Carb.).

Orthis vanuxemi var. pulchella Herrick, Bull. Denison Univ., III, 1888, p. 38, pl. 5, fig. 9.

Orthis vanuxemi var. gracilis Herrick, Geol. Ohio, VII, 1895, pl. 21, fig. 9.

Loc. Granville, Ohio.

RHYNCHONELLA Fischer de Waldheim. Genotype R. loxia Fischer de Waldheim.

Rhynchonella Fischer de Waldheim, Notice des Fos. Gouv. Moscou, 1809, p. 35, tab. II, figs. 5, 6.—Hall, Thirteenth Rep. N. Y. State Cab. Nat. Hist., 1860, p. 65.—Meek and Hayden, Pal. Upper Missouri, Smithsonian Cont. to Knowl., XIV, 172, 1864, p. 70.—Hall, Pal. New York, IV, 1867, p. 332;—Twentieth Rep. N. Y. State Cab. Nat. Hist., 1867, p. 269.—Dall, American Jour. Conch., VI, 1870, p. 151;—Ibidem, VII, 1871, p. 70.—Billings, Pal. Fossils, II, 1874, p. 35.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 72.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pp. 177, 178;—Thirteenth Ann. Rep. N. Y. State Geologist, 1895, p. 822.

Rhynchonella ænigma (d'Orbigny). Jurassic.

Terebratula ænygma d'Orbigny, Voyage dans l'Amérique Méridionale, Pal., 1842, p. 62, pl. 22, figs. 10–13.

Terebratula concinna (non Sowerby) Bayle and Coquand, Mém. Soc. Géol. France, ser. ii, IV, 1851, p. 23, pl. 8, figs. 4–6.

Rhynchonella ænigma Gottsche, Palæontographica, Suppl., III, 1878, p. 34.

Rhynchonella cfr. ænigma Steinman. Neues Jahrb. f. Min., Beilageband, 1881, p. 253.

Loc. Guasco, Coquimbo, Dona Ana, Chile; Copiapo, Caracoles, and Iquique, Peru.

Rhynchonella æquiplicata Gabb. Triassic.

Rhynchonella æquiplicata Gabb, Geol. Survey California, Pal., I, 1864, p. 35, pl. 6, fig. 37.

Loc. Cinnabar district, Humboldt Mountain, Nevada.

Rhynchonella æquiradiata Miller=Camarotœchia æquiradiata.

Rhynchonella æquivalvis Hall=Lissopleura æquivalvis.

Rhynchonella abrupta Hall=Uncinulus abruptus.

Rhynchonella acadiaensis Davidson. Upper Carboniferous.

Rhynchonella acadiensis Davidson, Quart. Jour. Geol. Soc. London, XIX, 1863, p. 172, pl. 9, fig. 16.—Dawson, Acadian Geol., 3d ed., 1878, p. 294, fig. 94.

Loc. Brookfield, Nova Scotia.

Rhynchonella acinus Hall=Camarotœchia acinus.

Rhynchonella acinus convexa Foerste=Camarotœchia acinus convexa.

Rhynchonella acutiplicata Hall. Lower Helderberg (Dev.).

Rhynchonella acutiplicata Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 73, fig. 7;—Pal. New York, III, 1859, p. 232, pl. 33, fig. 3.

Loc. Schoharie, New York.

Rhynchonella (?) acutirostris Hall. Chazy (Ord.).

Atrypa acutirostra Hall, Pal. New York, I, 1847, p. 21, pl. 4 bis, fig. 6.

Rhynchonella acutirostris Hall, Twelfth Rep. N. Y. State Cab. Nat. Hist., 1859, p. 65.

Loc. Chazy, New York.

Obs. This species is referred to Zygospira by Whitfield.

Rhynchonella ainsliei Winchell=Rhynchotrema ainsliei.

Rhynchonella algeri McChesney. Upper Carboniferous.

Rhynchonella algeri McChesney, New Pal. Fossils, 1860, p. 51.

Loc. Near New Harmony, Indiana.

Rhynchonella allegania Williams. Chemung (Dev.).

Rhychonella allegania Williams, Bull. U. S. Geol. Survey, 41, 1887, p. 87, pl. 4, figs. 1–8.

Loc. Olean and Little Genesee, New York; Bradford, Pennsylvania.

Rhynchonella alta Calvin=Pugnax pugnus alta.

Rhynchonella altilis Hall=Camarotœchia plena.

Rhynchonella altiplicata Hall. Lower Helderberg (Dev.).

Rhynchonella altiplicata Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 72, figs. 1–4;—Pal. New York, III, 1859, p. 231, pl. 33, fig. 2.

Loc. Albany and Schoharie counties, New York.

Rhynchonella alveata Hall=Centronella alveata.

Rhynchonella ambigua Calvin. Middle Devonian.

Rhynchonella ambigua Calvin, Bull. U. S. Geol. and Geogr. Survey Terr., IV, 1878, p. 729.

Loc. Independence, Iowa.

Rhynchonella anduin Gottsche. Jurassic.

Terebratula ænigma (non d'Orb.) Darwin, Geol. Observations South America, 1846, pp. 215, 233, pl. 5, figs. 10–12.—Burmeister and Giebel, Abh. Naturf. Gessel. Halle, VI, 1862, p. 128.

Terebratula subtetræda (non Davidson) Conrad, U. S. Astronomical Exped. Southern Hemisphere, 1855, p. 282, pl. 42, fig. 8.

Rhynchonella anduin Gottsche, Palæontographica, Suppl., III, 1878, p. 34, pl. 4, figs. 4–7.

Loc. Iquique, Portezuelo de Manflas, and Cordillera de Dona Ana, Chile.

Rhynchonella angulata Geinitz (non Linné)=Enteletes hemiplicatus.

Rhynchonella (?) anticostiensis Billings. Lorraine (Ord.).

Rhynchonella anticostiensis Billings, Pal. Fossils, I, 1862, p. 142, fig. 119;—Geol. Canada, 1863, p. 211, fig. 212.

Rhynchonella (?) anticostiensis Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 464, fig. 34.

Rhynchonella anticostiensis var. Whiteaves, Pal. Foss., III, Pt. III, 1897, p. 179.

Loc. Anticosti; Wilmington and Savanna, Illinois; Lattners, Iowa; Wisconsin; Manitoba.

Obs. Compare with R. argenturbica White.

Rhynchonella (?) antisiensis (d'Orbigny). Lower Devonian.

Terebratula antisiensis d'Orbigny, Voyage dans l'Amérique Méridionale, Pal., 1842, p. 36, pl. 2, figs. 26–28.

† Rhynchonella cf. antisiensis A. Ulrich, N. Jahrb. f. Mineral., Beilageband, VIII, 1892, p. 57, pl. 4, figs. 1–7.

Loc. Cochabamba, Tarabuco, Bolivia.

Rhynchonella antonii Gabb. ?Cretaceous.
Rhynchonella antonii Gabb, Jour. Acad. Nat. Sci. Philadelphia, 2d ser., IV, 1881, p. 299, pl. 42, fig. 10.
Loc. Cerro de San Antonio, and near Chota, Peru.

Rhynchonella arctirostrata Swallow. St. Louis (L. Carb.).
Rhynchonella arctirostrata Swallow, Trans. St. Louis Acad. Sci., II, 1863, p. 84.
Loc. Cooper County, Missouri.
Obs. Regarded by Keyes as a synonym for R. subcuneata = Camarophoria subcuneata.

Rhynchonella (?) argentea Billings. Anticosti (Sil.).
Rhynchonella ? argentea Billings, Catalogue Silurian Fossils Anticosti, 1866, p. 43.
Loc. Anticosti.

Rhynchonella argenturbica White=Rhynchotreta inæquivalvis.

Rhynchonella aspasia Billings. Lower Helderberg (Dev.).
Rhynchonella aspasia Billings, Proc. Portland Soc. Nat. Hist., I, 1863, p. 111, pl. 3, fig. 6.
Loc. Square Lake, Maine.

Rhynchonella barquensis A. Winchell. Marshall (L. Carb.).
Rhynchonella barquensis A. Winchell, Proc. Acad. Nat. Sci. Philadelphia, 1862, p. 408.
Loc. Port aux Barques, Michigan.

Rhynchonella barrandi Hall=Camarotœchia barrandei.

Rhynchonella (?) belliformis Nettelroth. Niagara (Sil.).
Rhynchonella bellaforma Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 73.
Loc. Louisville, Kentucky.

Rhynchonella belemnitica Quenstedt. Jurassic.
Rhynchonella belemnitica (Quenst.) Moricke, N. Jahrb. f. Mineral., Beilageband, IX, 1894, p. 61.
For locality and observations see R. plicatissima.

Rhynchonella bialveata Hall. Lower Helderberg (Dev.).
Rhynchonella ? bialveata Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 73;—Pal. New York, III, 1859, p. 233, pl. 34, figs. 1–4.
Loc. Albany County, New York; Square Lake, Maine.

Rhynchonella (?) bidens Hall. Clinton (Sil.).
Atrypa bidens Hall, Pal. New York, II, 1852, p. 69, pl. 23, fig. 3.
Rhynchonella bidens Hall, Twelfth Rep. N. Y. State Cab. Nat. Hist., 1859, p. 77.
Loc. Lockport, New York.

Rhynchonella (?) bidentata (Hisinger). Niagara (Sil.).
Terebratula bidentata Hisinger, Kongl. Svenska Vet.-Akad. Handl., för 1825, 1826, p. 343, pl. 7, fig. 5.
Atrypa bidentata Hall, Pal. New York, II, 1852, p. 276, pl. 57, fig. 3.
Rhynchonella bidentata Hall, Twelfth Rep. N. Y. State Cab. Nat. Hist, 1859, p. 77.
Loc. Lockport, New York.

Rhynchonella billingsi Hall=Camarotœchia billingsi.
Rhynchonella booensis Shumard=Leiorhynchus boonense.
Rhynchonella brevirostris Billings=Anastrophia brevirostris.

Rhynchonella camerifera A. Winchell. Marshall (L. Carb.).
Rhynchonella camerifera A. Winchell, Proc. Acad. Nat. Sci. Philadelphia, 1862, p. 408.
Loc. Port aux Barques, Michigan.

Rhynchonella campbellana Hall=Uncinulus campbellanus.

Rhynchonella camura Hall=Trematospira camura.

Rhynchonella capax Hall=Rhynchotrema capax.

Rhynchonella caput-testudinis White=Camarophoria caput-testudinis.

Rhynchonella caracolensis Gottsche. Jurassic.
Rhynchonella caracolensis Gottsche, Palæontographica, Suppl., III, 1878, p. 44, pl. 4, fig. 8.—Steinman, Neues Jahrb. f. Mineral., Beilageband, 1881, p. 253.—Möricke, Ibidem, Beilageband, IX, 1894, p. 61.
Loc. Iquique, Chile; Caracoles, Bolivia.

Rhynchonella carbonaria McChesney. Upper Carboniferous.
Rhynchonella carbonaria McChesney, New Pal. Fossils, 1860, p. 51.
Loc. Near Farmington, Illinois.

Rhynchonella carica Hall=Camarotœchia carica.

Rhynchonella carolina Hall=Camarotœchia carolina.

Rhynchonella castanea Meek=Hypothyris castanea.

Rhynchonella congregata Hall=Camarotœchia congregata.

Rhynchonella contracta Hall=Camarotœchia contracta.

Rhynchonella contracta var. saxatilis Hall=Camarotœchia contracta saxatilis.

Rhynchonella colletti Miller. Niagara (Sil.).
Rhynchonella colletti Miller, Eighteenth Ann. Rep. Geol. Survey Indiana, 1894, p. 311, pl. 9, figs. 8, 9.
Loc. Wabash, Indiana.

Rhynchonella cooperensis Shumard. Kinderhook (L. Carb.).
Rhynchonella cooperensis Shumard, Geol. Rep. Missouri, 1855, p. 204, pl. C, fig. 4.
?Camarophoria cooperensis Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 224, pl. 18, fig. 6.
Loc. Cooper County, Missouri; Eureka district, Nevada.

Rhynchonella (?) corinthia Billings. Calciferous (Ord.).
Rhynchonella corinthia Billings, Pal. Fossils, I, 1865, p. 220.
Loc. Table Head, Newfoundland.

Rhynchonella cuneata Billings, and Hall = Rhynchotreta cuneata americana.

Rhynchonella dawsoniana Davidson=Pugnax dawsoniana.

Rhynchonella (?) decemplicata Sowerby. Clinton (Sil.).
Rhynchonella decemplicata Foerste, Proc. Boston Soc. Nat. Hist., XXIV, 1890, p. 320, pl. 6, figs. 23, 24.
Loc. England; Cumberland Gap, Tennessee.

Rhynchonella dentata Hall=Rhynchotrema dentatum.

Rhynchonella dotis Hall=Camarotœchia dotis.

Rhynchonella dryope Billings. Oriskany (Dev.).
Rhynchonella dryope Billings, Pal. Fossils, II, 1874, p. 37, pl. 3A, fig. 1.
Loc. Grand Greve, Gaspé.

Rhynchonella dubia Hall=Protorhyncha dubia.
Rhynchonella duplicata Hall=Camarotœchia duplicata.
Rhynchonella eatoniæformis McChesney=Pugnax rockymontana.

Rhynchonella emacerata Hall. Clinton (Sil.).
Atrypa emacerata Hall, Pal. New York, II, 1852, p. 71, pl. 23, fig. 6.—Dawson, Acadian Geology, 3d ed., 1878, p. 599.
Rhynchonella emacerata Hall, Twelfth Rep. N. Y. State Cab. Nat. Hist., 1859, p. 77.
Loc. Sodus and Rochester, New York; Arisaig, Nova Scotia.

Rhynchonella eminens Hall. Lower Helderberg (Dev.).
Rhynchonella eminens Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 78;—Pal. New York, III, 1859, p. 237, pl. 37, figs. 3, 4.
Loc. Albany County, New York.

Rhynchonella emmonsi Hall and Whitfield=Hypothyris emmonsi.
Rhynchonella endlichi Meek=Camarotœchia endlichi.

Rhynchonella ererensis Rathbun. Middle Devonian.
Rhynchonella ererensis Rathbun, Proc. Boston Soc. Nat. Hist., XX, 1879, p. 32.
Loc. Erere, Province of Para, Brazil.

Rhynchonella eurekaensis Walcott. Lower Carboniferous.
Rhynchonella eurekensis Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 223, pl. 18, fig. 8.
Loc. Eureka district, Nevada.

Rhynchonella (?) eva Billings. Anticosti (Sil.).
Rhynchonella eva Billings, Catalogue Sil. Foss. Anticosti, 1866, p. 44.
Loc. Anticosti.

Rhynchonella evangelina Hartt. Upper Carboniferous.
Rhynchonella evangelina Hartt, Dawson's Acadian Geology, 3d ed., 1878, p. 299.
Loc. Windsor, Nova Scotia.
Obs. Compare with Pugnax pugnus as identified by Davidson, from the same locality.

Rhynchonella excellens Billings. Oriskany (Dev.).
Rhynchonella excellens Billings, Pal. Fossils, II, 1874, p. 36, figs. 17, 18.
Loc. Indian Cove, Gaspé.

Rhynchonella eximia Hall=Camarotœchia eximia.
Rhynchonella explanata McChesney=Camarophoria explanata.

Rhynchonella fitchana Hall. Oriskany (Dev.).
Rhynchonella fitchana Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 85;—Pal. New York, III, 1859, p. 441, pl. 103, fig. 1.
Loc. Carlisle, New York.

Rhynchonella formosa Hall=Rhynchotrema formosum.
Rhynchonella fringilla Billings=Camarotœchia fringilla.

Rhynchonella gainesi Nettelroth. Hamilton (Dev.).
Rhynchonella gainesi Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geological Survey, 1889, p. 76, pl. 31, figs. 6–9.
Loc. Jefferson County, Kentucky.

Rhynchonella glacialis Billings=Camarotœchia glacialis.
Rhynchonella glansfagea Hall=Centronella glansfagea.

Rhynchonella gnathophora Meek. Jurassic.

Rhynchonella gnathophora Meek, Geol. Survey California, Pal., I, 1864, p. 39, pl. 8, fig. 1.

Rhynchonella gnathophora? Hall and Whitfield, King's U. S. Geol. Expl. 40th Parl., IV, 1877, p. 284, pl. 7, fig. 6.

Loc. Plumas County, California; Uinta Range, Utah.

Rhynchonella greenana Ulrich=Leiorhynchus greeneanum.

Rhynchonella guadalupæ Shumard. Upper Carbonifcrous.

Rhynchonella guadalupe Shumard, Trans. St. Louis Acad. Sci., I, 1858, p. 295, pl. 11, fig. 6.

Loc. Guadalupe Mountains, New Mexico and Texas.

Rhynchonella halli Gabb. Triassic.

Rhynchonella halli Gabb, Jour. Acad. Nat. Sci. Philadelphia, 2d ser., IV, 1860, p. 308, pl. 48, fig. 29.

Loc. Bath County, Virginia.

Rhynchonella heteropsis A. Winchell. Kinderhook (L. Carb.).

Rhynchonella heteropsis A. Winchell, Proc. Acad. Nat. Sci. Philadelphia, 1865, p. 121.

Loc. Burlington, Iowa; Hamburg, Illinois; Medina County, Ohio.

Rhynchonella horsfordi Hall=Camarotœchia horsfordi.

Rhynchonella hubbardi A. Winchell. Marshall (L. Carb.).

Rhynchonella hubbardi A. Winchell, Proc. Acad. Nat. Sci. Philadelphia, 1862, p. 407;—Ibidem, 1865, p. 122.

Loc. Marshall and Port aux Barques, Michigan; Summit County, Ohio.

Rhynchonella huronensis A. Winchell. Huron (Dev.).

Rhynchonella huronensis A. Winchell, Proc. Acad. Nat. Sci. Philadelphia, 1862, p. 409.

Loc. Port aux Barques, Michigan.

Rhynchonella huronensis precipua A. Winchell. Huron (Dev.).

Rhynchonella huronensis var. precipua A. Winchell, Proc. Acad. Nat. Sci. Philadelphia, 1862, p. 409.

Loc. Port aux Barques, Michigan.

Rhynchonella (?) hydraulica Whitfield. Waterlime (Sil.).

Rhynchonella hydraulica Whitfield, Annals N. Y. Acad. Sci., II, 1882, p. 194;—Ibidem, V, 1891, p. 512, pl. 5, fig. 17;—Geol. Ohio, VII, 1895, p. 414, pl. 1, fig. 17.

Loc. Greenfield, Ohio.

Rhynchonella ida Hartt. Upper Carboniferous.

Rhynchonella ida Hartt, Dawson's Acadian Geology, 3d ed., 1878, p. 298.

Loc. Windsor, Nova Scotia.

Rhynchonella illinoisensis Worthen. Upper Carboniferous.

Rhynchonella illinoisense Worthen, Bull. Illinois State Mus. Nat. Hist., 2, 1884, p. 24;—Geol. Survey Illinois, VIII, 1890, p. 104, pl. 11, fig. 3.

Loc. Peoria, Illinois.

Rhynchonella increbescens Hall, 1860 (non 1847)=Rhynchotrema capax.

Rhynchonella increbescens Hall=Rhynchotrema inæquivalve.

Rhynchonella indentata Shumard. Upper Carboniferous.

Rhynchonella indentata Shumard, Trans. St. Louis Acad. Sci., I, 1859, p. 393.

Loc. Guadalupe Mountains, New Mexico.

Rhynchonella indianensis Hall=Camarotœchia indianaensis.

Rhynchonella inæquiplicata Hall. Upper Helderberg (Dev.).
Rhynchonella inequiplicata Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 126.
Loc. "Western New York."

Rhynchonella intermedia Barris=Hypothyris emmonsi.

Rhynchonella inutilis Hall. Lower Helderberg (Dev.).
Rhynchonella inutilis Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 74;—Pal. New York, III, 1859, p. 223, pl. 34, figs. 7, 8.
Loc. Albany County, New York.

Rhynchonella (?) janea Billings. Lorraine and Anticosti (Ord. and Sil.).
Rhynchonella janea Billings, Catalogue Sil. Fossils Anticosti, 1866, p. 43.—Foerste, Proc. Boston Soc. Nat. Hist., XXIV, 1890, p. 316, pl. 5, figs. 23, 24.
Loc. Anticosti; Collinsville, Alabama.

Rhynchonella kokomoensis Miller=Wilsonia kokomoensis.

Rhynchonella lacunosa (Schlotheim). Jurassic.
Terebratulites lacunosa Schlotheim, Leonhardt's Min. Tasch., VII, 1813, pl. 1, fig. 2.
Rhynchonella lacunosa Davidson, British Oolitic and Liassic Brach., Pal. Soc., 1852, p. 96, pl. 16, figs. 13, 14.—Aguilera, Datos para la Geologia de Mexico, 1893, p. 18;—Bol. Com. Geológica de Mexico, I, 1895, p. 1, pl. 1, figs. 1–13.
Loc. Europe; Rancho Alamitos, Sierra de Catorce, Mexico.

Rhynchonella lacunosa arolica Oppel. Jurassic.
Rhynchonella lacunosa var. arolica Aguilera, Datos para la Geologia de Mexico, 1893, p. 18;—Bol. Com. Geológica de Mexico, I, 1895, p. 1, pl. 1, figs. 14–25; pl. 2, figs. 1, 2.
Loc. Europe; Rancho Alamitos, Sierra de Catorce, Mexico.

Rhynchonella lævis Simpson. Clinton (Sil.).
Rhynchonella (Stenochisma) lævis Simpson, Trans. American Philosophical Soc., n. ser., XVI, 1889, p. 443, fig. 8.
Loc. Blair County, Pennsylvania.

Rhynchonella (?) lamellata Hall. Coralline (Sil.).
Atrypa lamellata Hall, Pal. New York, II, 1852, p. 329, pl. 74, fig. 11.
Rhynchonella lamellata Hall, Twelfth Rep. N. Y. State Cab. Nat. Hist., 1859, p. 78.
Loc. Schoharie, New York.

Rhynchonella laura Billings=Leiorhynchus laura.

Rhynchonella lingulata Gabb. Triassic.
Rhynchonella lingulata Gabb, Geol. Survey California, Pal., I, 1864, p. 34, pl. 6, fig. 36.
Loc. Humboldt County, Nevada.

Rhynchonella louisvillensis Nettelroth. Corniferous (Dev.).
Rhynchonella louisvillensis Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 77, pl. 31, figs. 1–4.
Loc. Falls of Ohio.

Rhynchonella macra Hall. St. Louis (L. Carb.).
Rhynchonella macra Hall, Trans. Albany Institute, IV, 1858, p. 11.—Whitfield, Bull. American Mus. Nat. Hist., I, 1882, p. 52, pl. 6, figs. 40–42.—Hall, Twelfth Rep. State Geol. Indiana, 1883, p. 334, pl. 29, figs. 40–42.
Loc. Alton, Illinois.

Rhynchonella mainensis Billings. Lower Helderberg (Dev.).

Rhynchonella mainensis Billings, Proc. Portland Soc. Nat. Hist., I, 1863, p. 110, pl. 3, fig. 4.

Loc. Square Lake, Maine.

Rhynchonella manflasensis Möricke. Jurassic.

Rhynchonella manflasensis Möricke, Neues Jahrb. f. Mineral., Beilageband, IX, 1894, p. 62, pl. 5, figs. 7a–7c.

Loc. Manflas and Melon, Chile.

Rhynchonella mansoni Salter=Atrypa mansonii.

Rhynchonella marshallensis A. Winchell=Camarotœchia marshallensis.

Rhynchonella maudensis Whiteaves. Cretaceous.

Rhynchonella maudensis Whiteaves, Mesozoic Fossils, Geol. Surv. Canada, I, 1884, p. 252, pl. 33, fig. 8.

Loc. Maud Island.

Rhynchonella medea Billings. Corniferous (Dev.).

Rhynchonella medea Billings, Canadian Jour., n. ser., V, 1860, p. 271;—Geol. Canada, 1863, p. 370, fig. 388.

Loc. Township of Rainham, Ontario.

Rhynchonella medialis Simpson. Waverly (L. Carb.).

Rhynchonella medialis Simpson, Trans. American Philosophical Soc., n. ser., XVI, 1889, p. 444, fig. 9.

Loc. Warren, Pennsylvania.

Rhynchonella (?) metallica White. Upper Carboniferous.

Rhynchonella metallica White, Wheeler's Expl. and Survey west 100th Merid., Prel. Rep., 1874, p. 20;—Ibidem, Final Rep., IV, 1875, p. 129, pl. 10, fig. 10.

Loc. Lincoln County, Nevada.

Obs. Probably an Uncinulus.

Rhynchonella mica Billings=Zygospira mica.

Rhynchonella (?) micropleura A. Winchell. Marshall (L. Carb.).

Rhynchonella (Retzia?) micropleura A. Winchell, Proc. Acad. Nat. Sci. Philadelphia, 1865, p. 122.

Loc. Battlecreek, Michigan.

Rhynchonella minnesotensis Sardeson=Rhynchotrema inæquivalvis.

Rhynchonella missouriensis Shumard, fig. 5a (non 5b, 5c)=Pugnax pugnus missouriensis.

Rhynchonella missouriensis Shumard, figs. 5b, 5c (non 5a)=Pugnax striaticostata.

Rhynchonella multistriata Hall. Oriskany (Dev.).

Rhynchonella multistriata Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 85;—Pal. New York, III, 1859, p. 440, pl. 102, fig. 3; pl. 106, fig. 3.

Loc. Helderberg Mountains, New York.

Rhynchonella mutabilis Hall=Uncinulus mutabilis.

Rhynchonella mutata Hall=Pugnax mutata.

Rhynchonella myrina Hall and Whitfield. Jurassic.

Rhynchonella species? Meek and Hayden, Smithsonian Cont. to Knowl., XIV, 172, 1865, p. 71, pl. 4, fig. 3.

Rhynchonella myrina Hall and Whitfield, King's U. S. Geol. Expl. 40th Parl., IV, 1877, p. 284, pl. 7, figs. 1–5.—Whitfield, Powell's Geol. Geogr. Survey Rocky Mountain Region, 1880, p. 347, pl. 3, figs. 6, 7.

Loc. Uinta Range, Utah; Black Hills, Dakota.

Rhynchonella neenah Whitfield. Lorraine (Ord.).
Rhynchonella neenah Whitfield, Geol. Wisconsin, IV, 1882, p. 265, pl. 12, figs. 19–22.
Rhynchonella (?) neenah Winchell and Schuchert, Geol. Survey Minnesota, III, 1893, p. 465, pl. 34, figs. 35–37.
Loc. Ironridge, Clifton, etc., Wisconsin; Savanna, Illinois; Lattners, Iowa.

Rhynchonella neglecta Hall=Camarotœchia neglecta.

Rhynchonella neglecta var. scobina Meek=Camarotœchia neglecta.

Rhynchonella nitens Dana=Terebratula nitens.

Rhynchonella nobilis Hall=Uncinulus nobilis.

Rhynchonella nucleolata Hall=Uncinulus nucleolatus.

Rhynchonella nucula (Sowerby). Silurian.
Terebratula nucula Sowerby, Murchison's Silurian System, 1839, pl. 5, fig. 20.
Rhynchonella nucula Etheridge, Quart. Jour. Geol. Soc. London, XXXIV, 1878, p. 595.
Loc. England; Bessels Bay, lat. 81° 6′.

Rhynchonella nutrix Billings. Anticosti (Sil.).
Rhynchonella nutrix Billings, Catalogue Silurian Fossils Anticosti, 1866, p. 43.
Loc. Anticosti.

Rhynchonella oblata Hall. Oriskany (Dev.).
Rhynchonella oblata Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 86;—Pal. New York, III, 1859, p. 439, pl. 102, figs. 1, 2.
Loc. Albany and Schoharie counties, New York.

Rhynchonella obsolescens Hall. Kinderhook (L. Carb.).
Rhynchonella (Eatonia) obsolescens Hall, Thirteenth Rep. N. Y. State Cab. Nat. Hist., 1860, p. 111.
Loc. Rockford, Indiana.

Rhynchonella obtusiplicata Hall=Camarotœchia obtusiplicata.

Rhynchonella occidens Walcott. Lower Devonian.
Rhynchonella occidens Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 152, pl. 15, fig. 3.
Loc. Eureka district, Nevada.

Rhynchonella opposita White and Whitfield. Kinderhook (L. Carb.).
Rhynchonella opposita White and Whitfield, Proc. Boston Soc. Nat. Hist., VIII, 1862, p. 294.
Loc. Burlington, Iowa.

Rhynchonella orbicularis Hall=Camarotœchia orbicularis.

Rhynchonella orientalis Billings. Chazy (Ord.).
Rhynchonella orientalis Billings, Canadian Nat. Geol., IV, 1859, p. 443, fig. 21;—Geol. Canada, 1863, p. 126, fig. 51.
Loc. Mingan Island.

Rhynchonella osagensis Swallow=Pugnax utah.

Rhynchonella ottumwa White=Pugnax ottumwa.

Rhynchonella parvini McChesney=Camarophoria subtrigona.

Rhynchonella perlamellosa Whitfield=Rhynchotrema perlamellosum.

Rhynchonella perrostellata Swallow. St. Louis (L. Carb.).
Rhynchonella perrostellata Swallow, Trans. St. Louis Acad. Sci., II, 1863, p. 95.
Loc. Cooper County, Missouri.

Rhynchonella persinuata A. Winchell. Kinderhook (L. Carb.).

Rhynchonella persinuata A. Winchell, Proc. Acad. Nat. Sci. Philadelphia, 1865, p. 121.

Loc. Burlington, Iowa.

Rhynchonella phoca Salter=Atrypa phoca.

Rhynchonella pipira Derby. Upper Carboniferous.

Rhynchonella pipira Derby, Bull. Cornell Univ., I, 1874, p. 24, pl. 3, figs. 18, 23, 25, 26, 31.

Loc. Bomjardim and Itaituba, Brazil.

Rhynchonella pisa Hall and Whitfield. Niagara (Sil.).

Rhynchonella pisa Hall and Whitfield, Pal. Ohio, II, 1875, p. 135, pl. 7, figs. 18–22.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geological Survey, 1889, p. 78, pl. 32, figs. 24–27.

Loc. Highland County, Ohio; Louisville, Kentucky.

Rhynchonella planiconvexa Hall. Lower Helderberg (Dev.).

Rhynchonella planoconvexa Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 75;—Pal. New York, III, 1859, p. 235, pl. 34, fig. 22.

Loc. Albany County, New York.

Rhynchonella plena Hall=Camarotœchia plena.

Rhynchonella pleiopleura Hall=Camarotœchia pleiopleura.

Rhynchonella pleurodon (Phillips). Upper Carboniferous.

Terebratula pleurodon Phillips, Geol. Yorkshire, II, 1836, p. 222, pl. 12, figs. 25–30.

Rhynchonella pleurodon Davidson, Mon. British Carb. Brach., 1860, p. 101, pl. 23, figs. 1–15.—Toula, Sitzungsb. der k. k. Akad. zu Wien, LIX, 1869, p. 7, pl. 1, fig. 6.—Etheridge, Quart. Jour. Geol. Soc. London, XXXIV, 1878, p. 632.

Loc. Europe; "Common in the Carboniferous rocks of America," Davidson; Bolivia; Feilden Isthmus, lat. 82° 43′.

Obs. Compare with Pugnax utah (Marcou).

Rhynchonella plicata Hall. Medina (Sil.).

Atrypa plicata Hall, Pal. New York, II, 1852, p. 10, pl. 4, fig. 6.

Rhynchonella plicata Hall, Twelfth Rep. N. Y. State Cab. Nat. Hist., 1859, p. 78.

Loc. Lockport, New York.

Rhynchonella plicatella (Linné). Niagara (Sil.).

Atrypa plicatella? Hall, Pal. New York, II, 1852, p. 279, pl. 58, figs. 3, 4.

Rhynchonella plicatella Hall, Twelfth Rep. N. Y. State Cab. Nat. Hist., 1859, p. 78.

Atrypa plicatella Miller, N. American Geol. Pal., 1889, p. 337.

Loc. Europe; Wolcott, New York.

Rhynchonella plicatilis (Sowerby). Cretaceous.

Terebratula plicatella Sowerby, Mineral Conchl., V, 1825, p. 167, tab. 503, fig. 1.

Rhynchonella plicatilis Davidson, British Cretaceous Brach., Pal. Soc., I, 1852, p. 75, pl. 10, figs. 37, 42.—Eichwald, Geog. Paleont. Bemerk. Halb. Mang. Aleutischen Inseln, 1871, p. 200.

Loc. England; Alaska.

Rhynchonella plicatissima Quenstedt. Jurassic.

Rhynchonella plicatissima (Quenst.) Möricke, Neues Jahrb. f. Mineral., Beilageband, IX, 1894, p. 61.

Loc. Sierra de la Ternera, Coquimbo, Guasco, and Copiapo, Chile.

Obs. Möricke says that Terebratula ænigma Forbes in great part belong to this *species* and R. belemnitica.

Rhynchonella plicifera Hall=Camarotœchia plena.

Rhynchonella principalis Hall. Oriskany (Dev.).
Rhynchonella principalis Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 84;—Pal. New York, III, 1859, p. 443, pl. 106, fig. 4.
Loc. Auburn, New York.

Rhynchonella prolifica Hall=Camarotœchia prolifica.

Rhynchonella pugnus of authors=Pugnax pugnus.

Rhynchonella pustulosa White=Rhynchopora pustulosa.

Rhynchonella pyramidata Hall=Uncinulus pyramidatus.

Rhynchonella pyrrha Billings. Anticosti (Sil.).
Rhynchonella pyrrha Billings, Catalogue Sil. Foss. Anticosti, 1866, p. 44.
Loc. Anticosti.

Rhynchonella ramsayi Hall. Oriskany (Dev.).
Rhynchonella ramsayi Hall, Pal. New York, III, 1859, p. 446, pl. 101A, figs. 7, 8.
Loc. Cumberland, Maryland.

Rhynchonella (?) raricosta Whitfield. Corniferous (Dev.).
Rhynchonella ? raricosta Whitfield, Annals N. Y. Acad. Sci., II, 1882, p. 201;—Ibidem, V, 1891, p. 522, pl. 6, fig. 6;—Geol. Ohio, VII, 1895, p. 421, pl. 2, fig. 6.
Loc. Columbus, Ohio.

Rhynchonella reticulata Hall=Dictyonella reticulata.

Rhynchonella ricinula Hall. St. Louis (L. Carb.).
Rhynchonella ricinula Hall, Trans Albany Institute, IV, 1858, p. 9.—Whitfield, Bull. American Mus. Nat. Hist., I, 1882, p. 53, pl. 6, fig. 46.—Hall, Twelfth Rep. State Geol. Indiana, 1883, p. 330, pl. 29, fig. 46.
Loc. Spergen Hill, Indiana.

Rhynchonella ringens Swallow=Camarophoria ringens.

Rhynchonella robusta Hall. Clinton (Sil.).
Atrypa robusta Hall, Pal. New York, II, 1852, p. 71, pl. 23, fig. 7.
Rhynchonella robusta Hall, Twelfth Rep. N. Y. State Cab. Nat. Hist., 1859, p. 78.
Loc. Lockport, New York.

Rhynchonella rockymontana Marcou=Pugnax rockymontana.

Rhynchonella royana Hall. Corniferous (Dev.).
Rhynchonella? (Stenocisma?) royana Hall, Pal. New York, IV, 1867, p. 338, pl. 54, figs. 20–23.
Loc. Near Leroy, New York.

Rhynchonella rudis Hall. Lower Helderberg (Dev.).
Rhynchonella rudis Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 75;—Pal. New York, III, 1859, p. 235, pl. 34, figs. 20, 21.
Loc. Hudson, New York.

Rhynchonella rugicosta Nettelroth. Niagara (Sil.).
Rhynchonella rugæcosta Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 78, pl. 32, figs. 48–51.
Loc. Louisville, Kentucky.

Rhynchonella saffordi Hall=Wilsonia saffordi.

Rhynchonella saffordi var. depressa=Wilsonia saffordi depressa.

Rhynchonella sageriana A. Winchell=Camarotœchia sageriana.

Rhynchonella sancta Sardeson=Rhynchotrema inæquivalve laticostatum.

Rhynchonella sappho Hall=Camarotœchia sappho.

Rhynchonella schucherti Stanton. Upper Cretaceous (Knoxville).
Rhynchonella schucherti Stanton, Bull. U. S. Geol. Survey, 133, 1896, p. 31, pl. 1, figs. 1–4.
Loc. Paskenta, California.

Rhynchonella scobina Meek=Camarotœchia neglecta.

Rhynchonella semiplicata (Conrad). Lower Helderberg (Dev.).
Atrypa semiplicata Conrad, Fifth Ann. Rep. Geol. Survey N. Y., 1841, p. 56.
Rhynchonella semiplicata Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 65, figs. 1, 2;—Pal. New York, III, 1859, p. 224, pl. 29, fig. 1.
Loc. Schoharie and Carlisle, New York.

Rhynchonella septata Hall. Oriskany (Dev.).
Rhynchonella septata Hall, Pal. New York, III, 1859, p. 443, pl. 103, fig. 2.
Loc. Albany County, New York.

Rhynchonella sordida Hall. Trenton (Ord.).
Atrypa sordida Hall, Pal. New York, I, 1847, p. 148, pl. 33, fig. 16.
Rhynchonella sordida Hall, Twelfth Rep. N. Y. State Cab. Nat. Hist., 1859, p. 66.
Loc. Not given.

Rhynchonella speciosa Hall=Camarotœchia speciosa.

Rhynchonella stephani Hall=Camarotœchia stephani.

Rhynchonella (?) striata Simpson. Waverly (L. Carb.).
Rhynchonella striata Simpson, Trans. American Phil. Soc., n. ser., XVI, 1889, p. 444, fig. 10.
Loc. Near Warren, Pennsylvania.
Obs. Compare with Camarophoria ringens and C. caput-testudinis.

Rhynchonella striatocostata Meek and Worthen=Pugnax striaticostata.

Rhynchonella stricklandi Sowerby=Uncinulus stricklandi.

Rhynchonella subacuminata Webster. Chemung (Dev.).
Rhynchonella subacuminata Webster, American Naturalist, XXII, 1888, p. 1015.
Loc. Near Rockford, Iowa.

Rhynchonella subcircularis A. Winchell. Marshall (L. Carb.).
Rhynchonella subcircularis A. Winchell, Proc. Acad. Nat. Sci. Philadelphia, 1862, p. 408.
Loc. Port aux Barques, Michigan.

Rhynchonella subcuneata Hall=Camarophoria subcuneata.

Rhynchonella subtetrædra (Conrad). ? Cretaceous.
Terebratula subtetrædra Conrad, U. S. Astronomical Exped. Southern Hemisphere, 1855, p. 282, pl. 42, fig. 8.
Loc. Portezuelo de Manplas and Cordillera de Dona Ana at an altitude of 13,432 feet above the ocean.

Rhynchonella subtrigona Meek and Worthen=Camarophoria subtrigona.

Rhynchonella subtrigonalis Hall. Trenton (Ord.).
Atrypa subtrigonalis Hall, Pal. New York, I, 1847, p. 145, pl. 33, fig. 12.
Rhynchonella subtrigonalis Hall, Twelfth Rep. N. Y. State Cab. Nat. Hist., 1859, p. 66.
Loc. Turin, New York.
Obs. Compare with Rhynchotrema inæquivalve.

Rhynchonella sulciplicata Hall. Lower Helderberg (Dev.).
Rhynchonella sulcoplicata Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 76.—Pal. New York, III, 1859, p. 236, pl. 35, fig. 1.
Loc. Albany County, New York.

Rhynchonella tayloriana (Lea). ? Jurassic.
Terebratula tayloriana Lea, Trans. American Phil. Soc., n. ser., VII, 1841, p. 259, pl. 10, fig. 12.
Loc. Habana, Cuba.

Rhynchonella tennesseensis Hall (non Roemer)=Uncinulus stricklandi.

Rhynchonella tennesseensis Roemer. Niagara (Sil.).
Rhynchonella tennesseensis Roemer, Die Sil. Fauna des West. Tennessee, 1860, p. 72, pl. 5, fig. 14.—Hall and Whitfield, Twenty-seventh Rep. N. Y. State Cab. Nat. Hist., 1875, pl. 9, figs. 24–26;—Pal. Ohio, II, 1875, p. 136, pl. 7, figs. 16, 17.
Loc. Perry County, Tennessee; Louisville, Kentucky; Yellow Springs, Ohio.

Rhynchonella tethys Billings=Camarotœchia tethys.

Rhynchonella tetrædra (Sowerby). Liassic.
Terebratula tetrædra Sowerby, Mineral Conchology, I, 1812, p. 191, pl. 83, fig. 5.—Bayle and Coquand, Mém. Soc. Géol. France, ser. ii, IV, 1851, p. 17, pl. 7, figs. 9–10.
Rhynchonella tetrædra Davidson, British Oolitic and Liassic Brach., Pal. Soc., 1852, p. 93, pl. 18, figs. 5–10.—Behrendsen, Zeit. der Deuschen geol. Gessel., XLIII, 1891, p. 396.—Möricke, Neues Jahrb. f. Mineral., Beilageband, IX, 1894, p. 63.
Loc. Europe; Portezuelo Ancho, Argentine Republic; Manflas, Las Amolanas, etc., Chile.

Rhynchonella (?) tetraptyx A. Winchell. Kinderhook (L. Carb.).
Rhynchonella ? tetraptyx A. Winchell, Proc. Acad. Nat. Sci. Philadelphia, 1865, p. 120.
Loc. Rockford, Indiana.

Rhynchonella tenuistriata Nettelroth. Corniferous (Dev.).
Rhynchonella tenuistriata Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 82, pl. 7, figs. 27–29.
Loc. Falls of Ohio.

Rhynchonella texana Shumard. Upper Carboniferous.
Rhynchonella texana Shumard, Trans. St. Louis Acad. Sci., I, 1859, p. 393.
Loc. Mouth of Delaware Creek, Texas.

Rhynchonella thalia Billings=Camarotœchia billingsi.
Rhynchonella thera Walcott=Camarophoria thera.

Rhynchonella transversa Hall. Lower Helderberg (Dev.).
Rhynchonella transversa Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 74, figs. 5, 6;—Pal. New York, III, 1859, p. 234, pl. 34, figs. 9–16.
Loc. Albany County, New York.

Rhynchonella triplicata Quenstedt. Jurassic.
Rhynchonella triplicata (Quenst.) Möricke, Neues Jahrb. f. Mineral., Beilageband, IX, 1894, p. 63.
Loc. Europe; Quebrada de la Iglesia, etc., Chile.

Rhynchonella tuta Miller. Burlington (L. Carb.).

Rhynchonella tuta Miller, Jour. Cincinnati Soc. Nat. Hist., IV, 1881, p. 315, pl. 7, fig. 11.

Loc. Lake Valley mining district, New Mexico.

Rhynchonella unica A. Winchell. Kinderhook (L. Carb.).

Rhynchonella unica A. Winchell, Proc. Acad. Nat. Sci. Philadelphia, 1865, p. 122.

Loc. Burlington, Iowa.

Rhynchonella unisulcata Hall=Pentagonia unisulcata.

Rhynchonella utah of authors=Pugnax utah.

Rhynchonella vellicata Hall=Uncinulus vellicatus.

Rhynchonella ventricosa Hall=Camarotœchia ventricosa.

Rhynchonella venustula Hall=Hypothyris cuboides.

Rhynchonella vicina Billings. Anticosti (Sil.).

Rhynchonella vicina Billings, Catalogue Sil. Foss. Anticosti, 1866, p. 44.

Loc. Anticosti.

Rhynchonella (?) warrenensis Swallow. Lower Devonian.

Rhynchonella warrenensis Swallow, Trans. St. Louis Acad. Sci., I, 1860, p. 653.

Loc. Callaway County, Missouri.

Rhynchonella wasatchensis White=Seminula wasatchensis.

Rhynchonella whitiana Miller=Camarotœchia whitei.

Rhynchonella whitii Hall (non Winchell)=Camarotœchia whitei.

Rhynchonella whitei A. Winchell. Marshall (L. Carb.).

Rhynchonella whitei A. Winchell, Proc. Acad. Nat. Sci. Philadelphia, 1862, p. 407.

Loc. Marshall, Michigan.

Rhynchonella whitneyi Gabb. Cretaceous (Shasta).

Terebratella whitneyi Gabb, Geol. Survey California, Pal., II, 1869, p. 35, pl. 2, fig. 62.

Rhynchonella whitneyi Gabb, Ibidem, 1869, p. 204, pl. 34, fig. 105.—Stanton, Bull. U. S. Geol. Survey, 133, 1896, p. 32, pl. 1, figs. 5–10.

Loc. Napa and Colusa counties, California.

Rhynchonella wilmingtonensis (Lyell and Sowerby). Eocene.

Terebratula wilmingtonensis Lyell and Sowerby, Quart. Jour. Geol. Soc. London, I, 1845, p. 431.

Rhynchonella wilmingtonensis Conrad, American Jour. Conch., I, 1865, p. 35.

Loc. Wilmington, North Carolina.

Rhynchonella wilsoni Sowerby=Wilsonia wilsoni.

Rhynchonella wortheni Hall=Camarophoria wortheni.

RHYNCHOPORA King. Genotype Terebratula geinitziana de Verneuil.

Rhynchopora King, Ann. Mag. Nat. Hist., 2d ser., XVII, 1856, p. 506.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 210;—Thirteenth Ann. Rep. N. Y. State Geologist, 1895, p. 832.

Rhynchoporina Œhlert, Fischer's Manuel de Conchyliologie, 1887, p. 1305.

Rhynchopora pustulosa (White). Kinderhook (L. Carb.).

Rhynchonella pustulosa White, Jour. Boston Soc. Nat. Hist., VIII, 1860, p. 226.—Hall and Whitfield, King's U. S. Geol. Expl. 40th Parl., IV, 1877, p. 257, pl. 4, figs. 12–14.

Rhynchopora pustulosa Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 210, pl. 58, figs. 1–4.

Loc. Burlington, Iowa; Wasatch Range, Utah; Lake Valley mining district, New Mexico (Miller).

RHYNCHOSPIRA Hall. Genotype Waldheimia formosa Hall.

Rhynchospira Hall, Twelfth Rep. N. Y. State Cab. Nat. Hist., 1859, p. 29;—Pal. New York, III, 1859, pp. 213, 484;—Sixteenth Rep. N. Y. State Cab. Nat. Hist., 1863, p. 58, figs. 12–17;—Pal. New York, IV, 1867, p. 276.—Hall and Clarke, Ibidem, VIII, Pt. II, 1893, p. 108, fig. 101;—Thirteenth Ann. Rep. N. Y. State Geologist, 1895, p. 791.

Retzia Billings, Canadian Journal, VI, 1861, p. 147.

Rhynchospira (?) acadiæ (Hall). Arisaig (Sil.).

Trematospira acadiæ Hall, Canadian Nat. Geol., V, 1860, p. 146, fig. 4.—Dawson, Acadian Geology, 3d ed., 1878, p. 597.

Loc. Nova Scotia.

Rhynchospira aprinis Hall=Homœospira apriniformis.

Rhynchospira (?) ashlandensis Herrick. Waverly (L. Carb.).

Rhynchospira ? ashlandensis Herrick, Bull. Denison Univ., IV, 1888, p. 25, pl. 3, fig. 16;—Geol. Ohio, VII, 1895, pl. 23, fig. 16.

Loc. Lyon Falls, Ohio.

Rhynchospira electra (Billings). Lower Helderberg (Dev.).

Retzia electra Billings, Proc. Portland Soc. Nat. Hist., 1863, p. 114, pl. 3, fig. 11.

Rhynchospira electra Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 111, pl. 50, figs. 29–31.

Loc. Square Lake, Maine.

Rhynchospira equiradiata Hall=Camarotœchia æquiradiata.

Rhynchospira (?) eugenia (Billings). Corniferous (Dev.).

Retzia eugenia Billings, Canadian Jour., VI, 1863, p. 147, fig. 58;—Geol. Canada, 1863, p. 373, fig. 395.

Rhynchospira (?) eugenia Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 111, pl. 50, figs. 41–43.

Loc. Walpole, Ontario.

Rhynchospira evax Hall=Homœospira evax.

Rhynchospira formosa Hall. Lower Helderberg (Dev.).

Waldheimia formosa Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 88.

Trematospira (Rhynchospira) formosa Hall, Pal. New York, III, 1859, p. 215, pl. 36, fig. 2; pl. 95A, figs. 7–11.

Rhynchospira formosa Hall, Pal. New York, IV, 1867, p. 278, figs. 1–6.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 109, fig. 101, pl. 50, figs. 21–25.

Retzia formosa Miller, N. American Geol. Pal., 1889, p. 366.—Whitfield, Annals N. Y. Acad. Sci., V, 1891, p. 512, pl. 5, figs. 15, 16;—Geol. Ohio, VII, 1895, p. 413, pl. 1, figs. 15–16.

Loc. Helderberg Mountains, New York; Square Lake, Maine; Greenfield, Ohio.

Rhynchospira globosa Hall. Lower Helderberg (Dev.).

Waldheimia globosa Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 87.

Trematospira (Rhynchospira) globosa Hall, Pal. New York, III, 1859, p. 215, pl. 36, fig. 1.

Rhynchospira globosa Hall and Clarke, Ibidem, VIII, Pt. II, 1893, p. 111.

Loc. Helderberg Mountains, New York.

Rhynchospira (?) helena (Nettelroth). Niagara (Sil.).

Trematospira helena Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 137, pl. 32, figs. 40–43.

Loc. Louisville, Kentucky.

Rhynchospira lepida Hall=Trigeria lepida.

Rhynchospira nobilis Hall=Cyclorhina nobilis.

Rhynchospira rectirostris Hall. Oriskany (Dev.).

Waldheimia rectirostra Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 89.

Trematospira (Rhynchospira) rectirostra Hall, Pal. New York, III, 1859, p. 217, pl. 95A, fig. 1, and p. 485.

Rhynchospira rectirostra Hall and Clarke, Ibidem, VIII, Pt. II, 1893, p. 111.

Loc. Cumberland, Maryland.

Rhynchospira scansa Hall and Clarke. Waverly (L. Carb.).

Rhynchospira scansa Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 50, fig. 45.

Loc. McKean County, Pennsylvania.

Rhynchospira (?) sinuata Hall. Arisaig (Sil.).

Rhynchospira sinuata Hall, Canadian Nat. Geol., V, 1860, p. 146.—Dawson, Acadian Geology, 3d ed., 1878, p. 597.

Retzia sinuata Miller, N. American Geol. Pal., 1889, p. 367.

Loc. Arisaig, Nova Scotia.

Rhynchospira subglobosa Hall=Retzia subglobosa.

RHYNCHOTREMA Hall. Genotype Rhynchonella capax Conrad.

Rhynchotrema Hall, Thirteenth Rep. N. Y. State Cab. Nat. Hist., 1860, p. 68, figs. 12–14.—Waagen, Palæontologica Indica, Ser. XIII, I, 1883, p. 410.—Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 458.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 182;—Thirteenth Ann. Rep. N. Y. State Geologist, 1895, p. 825.

Rhynchotrema ainsliei N. H. Winchell. Trenton (Ord.).

Rhynchonella ainsliei N. H. Winchell, Fourteenth Ann. Rep. Geol. Nat. Hist. Survey Minnesota, 1886, p. 315, pl. 2, figs. 5, 6.

Rhynchotrema ainsliei Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 459, pl. 34, figs. 1–8.

Loc. Minneapolis, St. Paul, etc., Minnesota; Decorah, Iowa.

Rhynchotrema capax (Conrad). Lorraine (Ord.).

Atrypa capax Conrad, Jour. Acad. Nat. Sci. Philadelphia, VIII, 1842, p. 264, pl. 14, fig. 21.

Atrypa increbescens (partim) Hall, Pal. New York, I, 1847, p. 146, pl. 33, figs. 13i, 13k–13y.—Billings, Canadian Nat. Geol., I, 1856, p. 207, figs. 15, 16.—Hall, Thirteenth Rep. N. Y. State Cab. Nat. Hist., 1860, p. 66. figs. 6, 7, 9–11.

Rhynchonella increbescens (partim) Hall, Geol. Wisconsin, I, 1862, p. 123, pl. 11, fig. 2.

Rhynchonella capax Billings, Geol. Canada, 1863, p. 211, fig. 213.—Meek, Pal. Ohio, I, 1873, p. 123, pl. 11, fig. 2.—Miller, Cincinnati Quart. Jour. Sci., II, 1875, p. 17.—White, Second Ann. Rep. Indiana Bureau of Statistics and Geol., 1880, p. 489, pl. 1, figs. 9–11;—Tenth Rep. State Geol. Indiana, 1881, p. 121, pl. 1, figs. 9–11.—Whitfield, Geol. Wisconsin, IV, 1882, p. 263, pl. 12, figs. 26, 27.—Keyes, Geol. Survey Missouri, V, 1895, p. 99, pl. 41, fig. 12.

Rhynchotrema capax Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 462, pl. 34, figs. 30–34.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pp. 183, 185, pl. 56, figs. 14–18, 20–27; pl. 83, fig. 31.—Whiteaves, Pal. Foss., III, Pt. III, 1897, p. 178.

Loc. Richmond, Indiana; Oxford, etc., Ohio; Wilmington, Illinois; Cape Girardeau, Missouri; Stockbridge, Ironridge, etc., Wisconsin; Lattners, Iowa; Spring Valley, Minnesota; Anticosti; Lake Winnipeg, Manitoba; Fort Churchill, Hudson Bay.

Rhynchotrema dentatum Hall. Trenton and Lorraine (Ord.).

Atrypa dentata Hall, Pal. New York, I, 1847, p. 148, pl. 33, fig. 14.

Rhynchonella dentata Hall, Twelfth Rep. N. Y. State Cab. Nat. Hist., 1859, p. 65.—Meek, Pal. Ohio, I, 1873, p. 121, pl. 11, fig. 3.—Miller, Cincinnati Quart. Jour. Sci., II, 1875, p. 18.—White, Second Ann. Rep. Indiana Bureau of Statistics and Geol., 1880, p. 490, pl. 1, figs. 12-14;—Tenth Rep. State Geol. Indiana, 1881, p. 122, pl. 1, figs. 12-14.

Rhynchotrema dentata Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 185.

?Rhynchonella dentata Keyes, Geol. Survey Missouri, V, 1895, p. 100, pl. 41, fig. 3.

Loc. Turin, New York; Dayton and Oxford, Ohio; Richmond, Indiana; near Nashville, Tennessee.

Rhynchotrema formosum (Hall). Lower Helderberg (Dev.).

Rhynchonella formosa Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 76, figs. 1-5;—Pal. New York, III, 1859, p. 236, pl. 35, fig. 6.

Stenocisma formosa Hall, Pal. New York, IV, 1867, p. 334.—Hall and Clarke, Ibidem, VIII, Pt. II, 1893, p. 187, pl. 56, figs. 41-45.

Loc. Schoharie and Albany counties, New York; Lake Temiscouata, New Brunswick, and Arisaig, Nova Scotia (Ami).

Rhynchotrema inæquivalve (Castelnau). Trenton (Ord.).

Spirifer inæquivalvis Castelnau, Essai Système Sil. l'Amérique Septentrionale, 1843, p. 40, pl. 14, fig. 8.

Atrypa increbescens (partim) Hall, Pal. New York, I, 1847, pp. 146, 289, pl. 33, figs. 13a-13h; ?pl. 79, fig. 6.

Rhynchonella increbescens (partim) Billings, Canadian Nat. Geol., I, 1856, p. 207, figs. 11-14.—Hall, Twelfth Rep. N. Y. State Cab. Nat. Hist., 1859, p. 66.—Billings, Geol. Canada, 1863, p. 168, fig. 153.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 83, pl. 34, figs. 26-29.

Rhynchonella argenturbica White, Wheeler's Expl. and Survey west 100th Merid., IV, Prel. Rep., 1874, p. 14;—Ibidem, Final Rep., 1875, p. 75, pl. 4, fig. 12.

Trematospira (?) quadriplicata Miller, Cincinnati Quart. Jour. Sci., II, 1875, p. 60, figs. 6, 7.

Rhynchotreta quadriplicata Miller, N. American Geol. Pal., 1889, p. 370.

Rhynchonella minnesotensis Sardeson, Bull. Minnesota Acad Nat. Sci., III, 1892, p. 333, pl. 4, figs. 21-23.

Rhynchotrema inæquivalvis Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 459, pl. 34, figs. 9-25.—Whiteaves, Pal. Foss., III, Pt. III, 1897, p. 179.

Rhynchotrema increbescens Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pp. 183, 185.

Loc. Drummonds Island (Castelnau); New York; Kentucky; Tennessee; Illinois; Wisconsin; Iowa; Minnesota; Silver City, New Mexico; Ottawa, Canada; Lake Winnipeg, Manitoba.

Obs. Compare Rhynchonella subtrigonalis.

Rhynchotrema inæquivalve laticostatum Win. and Schuch. Trenton (Ord.).

Rhynchotrema inæquivalvis var. laticostata W. and S., American Geol., IX, April 1, 1892, p. 293;—Minnesota Geol. Survey, III, 1893, p. 461, pl. 34, figs. 26-29.

Rhynchonella sancta Sardeson, Bull. Minnesota Acad. Nat. Sci., III, April 9, 1892, p. 333, pl. 4, figs. 19, 20.

Loc. Cannon Falls, Minnesota.

Rhynchotrema ottawaense (Billings). Trenton (Ord.).

Porambonites? ottawaensis Billings, Pal. Fossils, I, 1862, p. 140, fig. 117.

Rhynchotrema ottawaense (Billings)—Continued.

Protorhyncha? and Orthorhynchula? ottawaensis Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pp. 181, 228.

Loc. Pauquette Rapids, Canada; near Murfreesboro, Tennessee.

Rhynchotrema perlamellosum (Whitfield). Lorraine (Ord.).

Rhynchonella perlamellosa Whitfield, Ann. Rep. Geol. Survey Wisconsin, 1877, p. 73.—James, The Palæontologist, 2, 1878, p. 15.—Whitfield, Geol. Wisconsin, IV, 1882, p. 265, pl. 12, figs. 23–25.

Loc. Delafield and Iron Ridge, Wisconsin; Oxford, Ohio.

RHYNCHOTRETA Hall. Genotype Rhynchonella cuneata Dalman.

Rhynchotreta Hall, Twenty-eighth Rep. N. Y. State Mus. Nat. Hist., 1879, p. 166, figs. 1–4;—Eleventh Rep. State Geol. Indiana, 1882, p. 309.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 84.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 185;—Thirteenth Ann. Rep. N. Y. State Geologist, 1895, p. 825.

Rhynchotreta cuneata americana Hall. Niagara (Sil.).

Atrypa cuneata Hall (non Dalman), Geol. N. Y.; Rep. Fourth Dist., 1843, Table of Organic Remains, 13, figs. 3, 4;—Pal. New York, II, 1852, p. 276, pl. 57, fig. 4.—Billings, Canadian Nat. Geol., I, 1856, p. 138, pl. 2, fig. 13.

Rhynchonella cuneata Hall, Twelfth Rep. N. Y. State Cab. Nat. Hist., 1859, p. 77.—Billings, Geol. Canada, 1863, p. 315, fig. 323.

Rhynchotreta cuneata var. americana Hall, Twenty-eighth Rep. N. Y. State Mus. Nat. Hist., 1879, p. 167, pl. 25, figs. 29–38;—Eleventh Rep. State Geol. Indiana, 1882, p. 310, pl. 25, figs. 29–38.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 85, pl. 32, figs. 58, 59, 62, 63.—Beecher and Clarke, Mem. N. Y. State Mus., I, 1889, p. 47, pl. 4, figs. 12–22.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 187, pl. 56, figs. 31-38.

Loc. Lockport, etc., New York; Hamilton, Ontario; Waldron and Osgood, Indiana; Louisville, Kentucky; Milwaukee, Wisconsin.

Rhynobolus Hall=Rhinobolus.

RŒMERELLA Hall and Clarke. Genotype Orbicula grandis Vanux.

Rœmerella Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 137, fig. 65;—Eleventh Ann. Rep. N. Y. State Geologist, 1894, p. 257.

Rœmerella grandis (Vanuxem). Hamilton (Dev.).

Orbicula grandis Vanuxem, Geol. N. Y.; Rep. Third Dist., 1842, p. 152, fig. 4.

Discina grandis Hall, Pal. New York, IV, 1867, p. 17, pl. 1, fig. 18; pl. 2, figs. 32, 33.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 33, pl. 3, fig. 3.

Discina (Orbiculoidea?) grandis Hall and Whitfield, Twenty-fourth Rep. N. Y. State Cab. Nat. Hist., 1872, p. 187;—Twenty-seventh Rep. Ibidem, 1875, pl. 9, figs. 33-35.

Rœmerella grandis Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 137, fig. 65, pl. 4E, figs. 29–31.

Loc. Cazenovia and Pratts Falls, New York; Columbus, Ohio; Falls of Ohio.

ROMINGERINA Hall and Cl. Genotype Centronella julia A. Winchell.

Romingerina Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 272;—Thirteenth Ann. Rep. N. Y. State Geologist, 1895, p. 855.

Romingerina julia (A. Winchell). Waverly (L. Carb.).

Centronella julia A. Winchell, Proc. Acad. Nat. Sci. Philadelphia, 1862, p. 405;—Ibidem, 1865, p. 123.—Hall, Pal. New York, IV, 1867, p. 419, pl. 61A, figs. 41–46.—Herrick, Bull. Denison Univ., III, 1888, p. 49, pl. 2, fig. 5.

Romingerina julia (A. Winchell)—Continued.

Romingerina julia Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 271, figs. 187, 188, pl. 79, figs. 28–30.

Loc. Port Aux Barques, Michigan; Cuyahoga and Licking counties, Ohio. ?In the Chemung at Rushford, New York (Williams).

SCAPHIOCŒLIA Whitfield. Genotype S. boliviaensis Whitfield.

Scaphiocœlia Whitfield, Trans. American Inst. Min. Engi., XIX, 1891, p. 106.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 275;—Thirteenth Ann. Rep. N. Y. State Geologist, 1895, p. 857.

Scaphiocœlia boliviaensis Whitfield. Middle Devonian.

Scaphiocœlia boliviensis Whitfield, Trans. American Inst. Min. Engi., XIX, 1891, p. 106, figs. 1–4.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 276, figs. 193–196.

Loc. Sercre or Quechista, Bolivia.

SCENIDIUM Hall. Genotype Orthis insignis Hall.

Skenidium Hall, Thirteenth Rep. N. Y. State Cab. Nat. Hist., 1860, p. 70, figs. 1–5.—Waagen, Palæontologica Indica, Ser. XIII, I, 1884, p. 549.

Scenidium Œhlert, Bull. Societe d'Etudes Scientifiques d'Angers, 1887, p. 4, extract.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 241.—Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 381.—Hall and Clarke, Eleventh Ann. Rep. N. Y. State Geologist, 1894, p. 276.

Scenidium anthonense Sardeson. Trenton (Ord.).

Skenidium halli Safford, Geol. Tennessee, 1869, p. 287 (undefined).

Skenidium anthonensis Sardeson, Bull. Minnesota Acad. Nat. Sci., III, 1892, p. 333, pl. 4, fig. 7.

Scenidium halli Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 242, pl. 7A, figs. 33–39.

Scenidium anthonensis Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 381, figs. 20–23.

Loc. Minneapolis, St. Paul, and Cannon Falls, Minnesota; Dixon, Illinois; Lebanon, Tennessee.

Scenidium devonicum Walcott=Dalmanella devonica.

Scenidium halli Safford=S. anthonense.

Scenidium insigne Hall. Lower Helderberg (Dev.).

Orthis insignis Hall, Pal. New York, III, 1859, p. 173.

Skenidium (Orthis) insignis Hall, Ibidem, 1859, pl. 10A, figs. 13–15.

Skenidium insignis Hall, Thirteenth Rep. N. Y. State Cab. Nat. Hist., 1860, p. 70, figs. 1–5;—Second Ann. Rep. N. Y. State Geol., 1883, p. 37, figs. 31–35.

Scenidium insigne Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 242, pl. 7, figs. 31–35.

Loc. Helderberg Mountains, New York; Perry County, Tennessee.

Scenidium (?) merope (Billings). Trenton and Lorraine (Ord.).

Orthis merope Billings, Pal. Fossils, I, 1862, p. 139, fig. 116.

Scenidium ? merope Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 242, pl. 7A, figs. 31, 32.

Loc. Ottawa, Canada; Cincinnati, Ohio; Burgin, Kentucky.

Scenidium pyramidale Hall. Niagara (Sil.).

Orthis pyramidalis Hall, Pal. New York, II, 1852, p. 251, pl. 52, fig. 2.

Skenidium pyramidalis Hall, Thirteenth Rep. N. Y. State Cab. Nat. Hist., 1860, p. 70.

Skenidium pyramidata Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 37, figs. 29, 30.

Scenidium pyramidale Hall—Continued.

Scenidium pyramidale Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 242, pl. 7, figs. 29, 30; pl. 7A, figs. 40–42.

Loc. Lockport, New York; Arisaig, Nova Scotia (Ami).

SCHIZAMBON Walcott. Genotype S. typicalis Walcott.

Schizambon Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 69.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 113, 167.—Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 360.—Hall and Clarke, Eleventh Ann. Rep. N. Y. State Geologist, 1894, p. 253.

Schizambonia Œhlert, Fischer's Manuel de Conchyliologie, 1887, p. 1266.

Schizambon (?) dodgei Winchell and Schuchert. Trenton (Ord.).

Schizambon (?) dodgii W. and S., Minnesota Geol. Survey, III, 1893, p. 361, pl. 30, figs. 5–7.

Loc. Sandyhill, New York.

Schizambon (?) fissus canadaensis (Ami). Utica (Ord.).

Siphonotreta scotica Whiteaves, American Jour. Sci., 3d ser., XXIV, 1882, p. 278;—Canadian Nat. Geol., X, 1883, p. 396.

Siphonotreta scotica var. canadensis Ami, Ottawa Naturalist, I, 1887, p. 124.

Schizambon (?) fissus var. canadensis Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 115, pl. 4, figs. 32–36.

Loc. Gloucester, Ontario.

Schizambon (?) lockei Winchell and Schuchert. Lorraine (Ord.).

Schizambon (?) lockii Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 362, pl. 30, figs. 8–10.

Loc. Cincinnati, Ohio.

Schizambon typicalis Walcott. Pogonip or Calciferous (Ord.).

Schizambon typicalis Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 70, pl. 1, fig. 3.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 114, fig. 65, pl. 4, figs. 27–30.

Loc. Eureka district, Nevada; Manitou, Colorado.

SCHIZOBOLUS Ulrich.

Genotype Discina truncata Hall=Lingula concentrica Vanuxem.

Schizobolus Ulrich, Cont. American Pal., I, 1886, p. 25, pl. 3, fig. 3.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 87, 165;—Eleventh Ann. Rep. N. Y State Geologist, 1894, p. 246.

Schizobolus concentricus (Vanuxem). Genesee (Dev.).

Lingula concentrica Vanuxem, Geol. N. Y.; Rep. Third Dist., 1842, p. 168, fig. 4.—Hall, Geol. N. Y.; Rep. Fourth Dist., 1843, p. 223, fig. 4.

Discina truncata Hall, Sixteenth Rep. N. Y. State Cab. Nat. Hist., 1863, p. 28;—Pal. New York, IV, 1867, p. 23, pl. 1, fig. 15; pl. 2, figs. 36, 37.

Discina (Trematis) truncata Hall and Whitfield, Twenty-fourth Rep. N. Y. State Cab. Nat. Hist., 1872, p. 187.

Trematis truncata Hall, Twenty-third Rep. Ibidem, 1873, pl. 13, fig. 20.

Schizobolus truncatus Ulrich, Cont. American Pal., I, 1886, p. 25, pl. 3, fig. 3.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 87, pl. 3, figs. 11–14.

Loc. Ogdens Ferry, Cayuga Lake, etc., New York; Falls of Ohio; Madison County, Kentucky.

SCHIZOCRANIA Hall and Whitfield. Genotype Orbicula ? filosa Hall.

Schizocrania Hall and Whitfield, Pal. Ohio, II, 1875, p. 71.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 142, 168.—Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 369.—Hall and Clarke, Eleventh Ann. Rep. N. Y. State Geologist, 1894, p. 259.

Schizocrania filosa Hall. Trenton-Lorraine (Ord.).

Orbicula? filosa Hall, Pal. New York, I, 1847, p. 99, pl. 30, fig. 9.

Trematis filosa Billings, Geol. Canada, 1863, p. 159, fig. 126.—Hall, Twenty-third Rep. N. Y. State Cab. Nat. Hist., 1873, pl. 13, figs. 21, 22.

Trematis (?) filosa Miller, Cincinnati Quart. Jour. Sci., II, 1875, p. 15.

Schizocrania filosa Hall and Whitfield, Pal. Ohio, II, 1875, p. 73, pl. 1, figs. 12–15.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 143, pl. 4G, figs. 22–30.—Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 370, fig. 31; pl. 29, figs. 29–31.

Loc. Middleville, Utica, etc., New York; Ottawa, Canada; Cincinnati, Ohio; Cannon Falls and Minneapolis, Minnesota.

Schizocrania (?) helderbergia Hall. Lower Helderberg (Dev.).

Schizocrania (?) helderbergia Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 144, 179, pl. 4G, figs. 34, 35.

Loc. Near Clarksville, New York.

Schizocrania (?) rudis Hall. Trenton (Ord.).

Trematis rudis Hall, Twenty-third Rep. N. Y. State Cab. Nat. Hist., 1873, p. 243, pl. 13, fig. 19.

Schizocrania (?) rudis Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 144, pl. 4G, fig. 21.

Loc. Clifton, Tennessee.

Schizocrania schucherti Hall and Clarke. Trenton (Ord.).

Schizocrania schucherti Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 143, 179, pl. 4G, figs. 31–33.

Loc. Covington, Kentucky.

Schizocrania superincreta Barrett. Lower Helderberg (Dev.).

Trematis (Schizocrania) superincreta Barrett, Annals N. Y. Acad. Sci., I, 1878, p. 122.

Schizocrania (?) superincreta Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 144.

Loc. Port Jervis, New York.

SCHIZOPHORIA King. Genotype Orthis resupinata (Martin).

Schizophoria King, Mon. Permian Fossils, Pal. Soc., 1850, p. 106.—Hall, Bull. Geol. Soc. America, I, 1889, p. 21.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 211;—Eleventh Ann. Rep. N. Y. State Geologist, 1894, p. 272.

Schizophoria carinata Hall. Chemung (Dev.).

Orthis carinata Hall, Geol. N. Y.; Rep. Fourth Dist., 1843, p. 267, fig. 1;—Pal. New York, IV, 1867, p. 58, pl. 8, figs. 30–32;—Second Ann. Rep. N. Y. State Geol., 1883, pl. 36, fig. 22.

Schizophoria carinata Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 213, 226, pl. 6, fig. 22.

Loc. Painted Post, High Point, etc., New York.

Schizophoria cora (d'Orbigny). Upper Carboniferous.

Orthis cora d'Orbigny, Voyage dans l'Amérique Méridionale, Pal., 1842, p. 48.

Terebratula cora d'Orbigny, Ibidem, 1842, pl. 3, figs. 21–23.

Orthis resupinata var. latirostrata Toula, Sitzungsb. der k. k. Akad. der Wissensch. zu Wien, LIX, 1869, p. 8. pl. 1, fig. 7.—Derby, Bull. Cornell Univ., I, 1874, p. 63.

Loc. Yarbichambi and Cochabamba, Bolivia.

Schizophoria macfarlani (Meek). Middle and Upper Devonian.

Orthis macfarlani Meek, Trans. Chicago Acad. Sci., I, 1868, p. 88, pl. 12, fig. 1.—Meek and Worthen, Geol. Survey Illinois, III, 1868, p. 423, pl. 13, fig. 10.—

Schizophoria macfarlani (Meek)—Continued.

Kayser, Richthofen's China, IV, 1883, p. 91, pl. 13, fig. 3.—Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 114.

Schizophoria macfarlanii Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 190, 212, 225, pl. 6A, figs. 28–32.

Loc. Independence, Iowa; Howard and High Point, New York; Mackenzie River, Canada; Lower Devonian, Eureka district, Nevada; Southwestern China.

Schizophoria manitobaensis Whiteaves. Upper Devonian.

Orthis (Schizophoria) manitobensis Whiteaves, Cont. Canadian Pal., I, 1892, p. 283, pl. 37, figs. 3, 4, 5.

Loc. Lake Winnipegosis, Canada.

Schizophoria multistriata Hall. Lower Helderberg (Dev.).

Orthis multistriata Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 45, figs. 1, 2;—Pal. New York, III, 1859, p. 176, pl. 15, fig. 2.

Schizophoria multistriata Hall and Clarke, Ibidem, VIII, Pt. I, 1892, pp. 212, 226, pl. 6A, fig. 25.

Loc. Schoharie and Catskill, New York.

Schizophoria (?) peduncularis Hall. Lower Helderberg (Dev.).

Orthis peduncularis Hall, Pal. New York, III, 1859, p. 174, pl. 13, fig. 16.

Schizophoria ? peduncularis Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 226.

Loc. Helderberg Mountains, New York.

Schizophoria propinqua Hall. Upper Helderberg (Dev.).

Orthis propinqua Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 110;—Pal. New York, IV, 1867, p. 43, pl. 5, fig. 3;—Second Ann. Rep. N. Y. State Geol., 1883, pl. 36, figs. 30, 31.

Schizophoria propinqua Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 212, 226, pl. 6, fig. 30.

Loc. New York; Columbus, Ohio.

Schizophoria resupinata (Martin). Carboniferous.

Orthis resupinata Hall and Whitfield, King's U. S. Geol. Expl. 40th Parl., IV, 1877, p. 265, pl. 5, figs. 1, 2.

Schizophoria resupinata Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 194, 213, 226.

Loc. Oquirrh Mountains, Utah; Lake Valley mining district, New Mexico.

Schizophoria resupinoides (Cox). Upper Carboniferous.

Orthis resupinoides Cox, Owen's Geol. Survey Kentucky, II, 1857, p. 570, pl. 9, fig. 1.—Worthen, Geol. Survey Illinois, VIII, 1890, p. 106, pl. 11, fig. 4.

Orthis resupinoides ? White, Wheeler's Expl. and Survey west 100th Meridian, Appendix, 1881, p. xxiii.

Schizophoria resupinoides Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 213, 226.

Schizophoria cfr. resupinoides Smith, Proc. American Phil. Soc., XXXV, 1897, p. 28 (extract).

Loc. Hancock County, Kentucky; Manuelitos Creek, New Mexico; ? White and Conway counties, Arkansas.

Obs. Probably identical with Schizophoria resupinata.

Schizophoria senecta Hall and Clarke. Clinton (Sil.).

Orthis (Schizophoria) senecta Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 343, pl. 6A, figs. 23, 24.

Loc. Reynales Basin, Niagara County, New York.

Schizophoria striatula (Schlotheim). Middle and Upper Devonian.

Anomia Terebratulites striatulus Schlotheim, Min. Taschenbuch, VIII, 1813, pl. 1, fig. 6.

Orthis striatula Davidson, Brit. Devonian Brach., Pal. Soc., 1865, p. 87, pl. 17, figs. 4–7.—Whiteaves (non Schlotheim), Cont. Canadian Pal., I, 1891, pp. 218, 283.

Orthis impressa Hall, Geol. N. Y.; Rep. Fourth Dist., 1843, p. 267, fig. 2;—Pal. New York, IV, 1867, p. 60, pl. 8, figs. 11–19.—Whitfield, Geol. Wisconsin, IV, 1882, p. 326, pl. 25, figs. 13–15.—Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 115, pl. 13, fig. 13.—Kindle, Bull. American Pal., 6, 1896, p. 36.

Orthis lentiformis? Owen (non Hall), Geol. Survey Wisconsin, Iowa, Minnesota, 1852, pl. 3, figs. 10, 10a, young specimen. [See specimens in U. S. Nat. Mus., Cat. Invert. Foss., 17918.]

Orthis iowensis Hall, Geol. Survey Iowa, I, Pt. II, 1858, p. 488, pl. 2, fig. 4.—Billings, Hind's Rep. Expl. Assiniboine and Saskatch., 1859, p. 187, fig. 1.—Meek, Trans. Chicago Acad. Sci., I, 1868, p. 90, pl. 12, fig. 2.—White, Second Ann. Rep. Indiana Bureau of Statistics and Geol., 1880, p. 501, pl. 5, figs. 10–12;—Tenth Rep. State Geol. Indiana, 1881, p. 133, pl. 5, figs. 10–12.—Keyes, Geol. Survey Missouri, V, 1895, p. 62, pl. 38, fig. 6.

Orthis iowensis var. furnarius Hall, Geol. Survey Iowa, I, Pt. II, 1858, p. 489, pl. 2, fig. 5.—Meek and Worthen, Geol. Survey Illinois, III, 1868, p. 424, pl. 13, fig. 9.

?Orthis iowensis ? A. Winchell, Proc. Acad. Nat. Sci. Philadelphia, 1862, p. 410.

Orthis propinqua Nettelroth (non Hall), Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 43, pl. 16, figs. 1–3, 7–11.

Schizophoria iowensis Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 212, 226, pl. 6A, fig. 29.

Schizophoria impressa Hall and Clarke, Ibidem, 1892, pp. 212, 216, pl. 6, fig. 31; pl. 6A, figs. 26, 27.

Loc. New York; Falls of Ohio; Illinois; Iowa; Milwaukee, Wisconsin; Perry County, Missouri; Eureka district, Nevada; Mackenzie River Valley, Northwest Territory, Canada.

Obs. The writer has compared American forms with O. striatula from the Eifel, Germany, and he agrees with authors in regarding both as one species. Orthis (Schizophoria) macfarlani is often found associated with O. striatula and may be only a variety of it.

Schizophoria swallovi Hall. Burlington (L. Carb.).

Orthis swallovi Hall, Geol. Survey Iowa, I, Pt. II, 1858, p. 597, pl. 12, fig. 5;—Second Ann. Rep. N. Y. State Geol., 1883, pl. 36, figs. 23, 24.—Keyes, Geol. Survey Missouri, V, 1895, p. 63, pl. 38, fig. 5.

Schizophoria swallovi Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 213, 226, pl. 6, figs. 23, 24.

Loc. Burlington, Iowa; Quincy, Illinois; Pike County, Missouri.

Obs. Compare with Rhipidomella clarkensis.

Schizophoria tioga Hall. Portage and Chemung (Dev.).

Orthis interlineata Hall (non Sowerby), Geol. N. Y.; Rep. Fourth Dist., 1843, p. 267, figs. 3, 4.

Orthis tioga Hall, Pal. New York, IV, 1867, p. 59, pl. 8, figs. 20–29;—Second Ann. Rep. N. Y. State Geol., 1883, pl. 36, figs. 17, 18.—Whitfield, Annals N. Y. Acad. Sci., V, 1891, p. 561, pl. 12, fig. 3;—Geol. Ohio, VII, 1895, p. 453, pl. 8, fig. 3.

Schizophoria tioga Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 212, 226, pl. 6, figs. 17, 18.

Loc. Factoryville, Elmira, etc., New York; Lake County, Ohio.

Schizophoria tulliensis (Vanuxem). Tully (Dev.).

Orthis tulliensis Vanuxem, Geol. N. Y.; Rep. Third Dist., 1842, p. 164, fig. 2.—Hall, Pal. New York, IV, 1867, p. 55, pl. 7, fig. 5.—Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 115, pl. 2, fig. 12.—Williams, Bull. Geol. Soc. America, I, 1890, p. 492, pl. 12, fig. 16.

Orthis resupinata Hall (non Martin), Geol. N. Y.; Rep. Fourth Dist., 1843, p. 215, fig. 2.

Orthis (Schizophoria) tulliensis Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 36, figs. 25–29.

Schizophoria tulliensis Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 212, 226, pl. 6, figs. 25–29.

Loc. Tully, Tinkers Falls, and Ovid, New York; Eureka district, Nevada.

SCHIZOTRETA Kutorga. Genotype S. elliptica Kutorga.

Schizotreta Kutorga, Verhand. Kais. Min. Gessel. zu St. Petersburg, VII, 1848, p. 273.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 135, 169.—Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 365.—Hall and Clarke, Eleventh Ann. Rep. N. Y. State Geologist, 1894, p. 257.

Schizotreta conica (Dwight). Trenton (Ord.).

Orbiculoidea conica Dwight, American Jour. Sci., 3d ser., XIX, 1880, p. 452, pl. 21, figs. 1–11.

Schizotreta conica Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 126, 135, pl. 4E, figs. 6–8; pl. 4F, fig. 7.

Loc. Near Newburg, New York.

Schizotreta minutula Winchell and Schuchert. Lorraine (Ord.).

Schizotreta minutula Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 366, fig. 28.

Loc. Near Granger, Minnesota.

Schizotreta ovalis Hall and Clarke. Trenton (Ord.).

Orbiculoidea (Schizotreta) ovalis Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 177, pl. 4E, figs. 4, 5.

Loc. Middleville, New York.

Schizotreta pelopea (Billings). Trenton and Lorraine (Ord.).

Discina pelopea Billings, Pal. Fossils, I, 1862, p. 52, fig. 56;—Geol. Canada, 1863, p. 159, fig. 124.

Discina concordensis Sardeson, Bull. Minnesota Acad. Nat. Sci., III, 1892, p. 328, pl. 4, figs. 13, 14.

Schizotreta pelopea, Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 365, pl. 29, figs. 26–28.

Loc. Montreal, Canada; Mantorville, Old Concord, and Spring Valley, Minnesota; Dubuque, Iowa; Neenah, Wisconsin; in the Utica at Ottawa, Canada (Ami).

Schizotreta tenuilamellata (Hall). Niagara (Sil.).

Orbicula tenuilamellata Hall, Pal. New York, II, 1852, p. 250, pl. 53, fig. 3.

Discina forbesi Nicholson (non Davidson), Pal. Prov. Ontario, 1875, p. 62.

Discina solitaria Ringueberg, American Naturalist, 1882, p. 175, figs. a–e.

Discina clara Spencer, Bull. Univ. State Missouri, 1, 1884, p. 56;—Trans. St. Louis Acad Sci., IV, 1886, p. 606, pl. 8, fig. 5.

Schizotreta tenuilamellata Beecher, American Jour. Sci., 3d ser., XLI, 1891, p. 357, pl. 17, fig. 11.

Orbiculoidea (Schizotreta?) tenuilamellata Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 127, 135, pl. 4E, figs. 9–11; pl. 4F, figs. 2–6.

Loc. Lockport, New York; Hamilton, Ontario, and Arisaig, Nova Scotia (Ami).

SELENELLA Hall and Clarke. Genotype S. gracilis Hall and Clarke.

Selenella Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 271;—Thirteenth Ann. Rep. N. Y. State Geologist, 1895, p. 855.

Selenella gracilis Hall and Clarke. Corniferous (Dev.).

Selenella gracilis Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 271, figs. 184–186.

Loc. Ontario.

SEMINULA McCoy emend Hall and Clarke.

Genotype Terebratula pentædra Phillips=Athyris ambigua (Phillips).

Seminula McCoy, Synopsis Carb. Fossils Ireland, 1844, pp. 150, 158.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 93;—Thirteenth Ann. Rep. N. Y. State Geologist, 1895, p. 781.

Seminula argentea (Shepard). Upper Carboniferous.

Terebratula argentea Shepard, American Jour. Sci., XXXIV, 1838, p. 152, fig. 8.

Terebratula roissyi d'Orbigny (non L'Éveillé), Voyage dans l'Amérique Méridionale, Pal., 1842, p. 46.

Terebratula antisiensis d'Orbigny, Ibidem, 1842, p. 46 (non p. 36).

Terebratula peruviana d'Orbigny, Ibidem, 1842, pl. 3, figs. 17–19 (non p. 36).

Terebratula subtilita Hall, Stansbury's Exped. Great Salt Lake of Utah, 1852, p. 409, pl. 4, figs. 1, 2.—Shumard, Marcy's Rep. U. S. Expl. Red River of Louisiana, 1853, p. 202, pl. 4, fig. 8.—Schiel, Pacific Railroad Rep., II, 1855, p. 108, pl. 1, fig. 2.—Hall, Ibidem, III, 1856, p. 101, pl. 2, figs. 3–5.—Marcou, Geol. N. America, 1858, p. 52, pl. 6, fig. 9.—Hall, Geol. Survey Iowa, I, Pt. II, 1858, p. 714.

Terebratula (?) subtilita Davidson, Mon. British Carboniferous Brach., Pal. Soc., 1857, p. 18, pl. 1, figs. 21, 22; 1860, p. 86; 1862, p. 217, pl. 17, figs. 8–10.

Spirigera subtilita Meek and Hayden, Proc. Acad. Nat. Sci. Philadelphia, 1859, p. 20.—White, Wheeler's Expl. and Survey west of the 100th Meridian, IV, 1875, p. 141, pl. 10, fig. 6.

Athyris differentis McChesney, New Pal. Fossils, 1860, p. 47.

Athyris subtilita Newberry, Ives's Rep. Colorado River of the West, 1861, p. 126.—Salter, Quart. Jour. Geol. Soc. London, XVII, 1861, p. 64, pl. 4, fig. 4.—Geinitz, Carbon und Dyas in Nebraska, 1866, p. 40, pl. 3, figs. 7–9.—Meek, Final Rep. U. S. Geol. Survey, Nebraska, 1872, p. 180, pl. 1, fig. 12; pl. 5, fig. 9; pl. 8, fig. 4.—Meek and Worthen, Geol. Survey Illinois, V, 1873, p. 570, pl. 25, fig. 14.—Derby, Bull. Cornell Univ., I, 1874, p. 7, pl. 1, figs. 5, 8 (not 7=Spirigerella derbyi); pl. 3, figs. 8, 16, 19; pl. 6, fig. 2; pl. 9, fig. 4.—Meek, Simpson's Rep. Expl. Great Basin Terr. Utah, 1876, p. 350, pl. 2, fig. 4;—Bull. U. S. Geol. and Geogr. Survey Terr., II, 4, 1876, pl. 1, fig. 2.—Derby, Bull. Mus. Comp. Zool., III, 1876, p. 279.—Newberry, Macomb's Rep. Expl. Exped. from Santa Fe to the Great Colorado River of the West, 1876, p. 138.—Meek, King's U. S. Geol. Expl. 40th Parl., IV, 1877, p. 83, pl. 8, fig. 6.—White, Thirteenth Rep. State Geol. Indiana, 1884, p. 136, pl. 35, figs. 6–9.—de Koninck, Annales du Musée Royal d'Histoire Naturelle de Belgique, XIV, 1887, p. 73, pl. 18, figs. 1–4, 7–10, 12–28; pl. 19, figs. 47–56.—Herrick, Bull. Denison Univ., II, 1887, p. 44, pl. 2, fig. 23.—Keyes, Proc. Acad. Nat. Sci. Philadelphia, 1888, p. 231.—Whitfield, Annals N. Y. Acad. Sci., V, 1891, p. 604, pl. 16, figs. 7–9;—Geol. Ohio, VII, 1895, p. 488, pl. 12, figs. 7–9.

Spirifera (Athyris) subtilita Toula, Sitzungsb. der k. k. Akad. der Wissensch. zu Wien, LIX, 1869, p. 6, pl. 1, fig. 5.

Seminula subtilita Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 95, figs. 66, 67, and 58, 59 on p. 86; pl. 47, figs. 17–31.

Athyris argentea Keyes, Geol. Survey Missouri, V, 1895, p. 92, pl. 39, fig. 11.

Loc. Throughout the Upper Carboniferous of North America; Brazil and Bolivia, South America; England; India; Thibet and Kashmere.

Obs. See Seminula charitonensis, S. caput-serpentis, S. hawni, and S. singletonii Swallow.

Seminula caput-serpentis (Swallow). Upper Carboniferous.

Spirigera caputserpentis Swallow, Trans. St. Louis Acad. Sci., II, 1863, p. 90.

Loc. Missouri and Kansas.

Obs. Regarded by Keyes as a synonym for S. argentea.

Seminula charitonensis (Swallow). Upper Carboniferous.

Spirigera charitonensis Swallow, Trans. St. Louis Acad. Sci., I, 1860, p. 651.

Loc. Chariton and Randolph counties, Missouri.

Obs. Probably a synonym for Seminula argentea.

Seminula claytoni (Hall and Whitfield). Kinderhook (L. Carb.).

Athyris claytoni Hall and Whitfield, King's U. S. Geol. Expl. 40th Parl., IV, p. 256, 1877, pl. 4, figs. 15–17.

Loc. Little Cottonwood, Wasatch Range, Utah.

Seminula dawsoni Hall and Clarke. Upper Carboniferous.

Athyris subtilita Davidson (non Hall), Quart. Jour. Geol. Soc. London, XIX, 1863, p. 170, pl. 9, figs. 4, 5.—Dawson, Acadian Geology, 3d ed., 1878, p. 290, fig. 88.

Seminula dawsoni Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pp. 95, 96, 364, figs. 69–71; pl. 47, figs. 32–34.

Loc. Windsor, Nova Scotia.

Seminula formosa (Swallow). Keokuk (L. Carb.).

Spirigera formosa and euzona Swallow, Trans. St. Louis Acad. Sci., II, 1863, p. 91.

Athyris formosa Keyes, Geol. Survey Missouri, V, 1895, p. 91.

Loc. Boonville, Missouri.

Seminula hawni (Swallow). Upper Carboniferous.

Spirigera hawni Swallow, Trans. St. Louis Acad. Sci., I, 1860, p. 652.

Loc. Missouri.

Obs. Probably a synonym for Seminula argentea.

Seminula maconensis (Swallow). Upper Carboniferous.

Spirigera maconensis Swallow, Trans. St. Louis Acad. Sci., I, 1860, p. 651.

Loc. Montgomery County, Missouri.

Seminula parva (Swallow). Keokuk (L. Carb.).

Terebratula parva Swallow (non d'Archiac, 1846), Trans. St. Louis Acad. Sci., II, 1863, p. 83.—Keyes, Geol. Survey Missouri, V, 1895, p. 105.

Terebratula cooperensis Miller, N. American Geol. and Pal., 1889, p. 384.

Loc. Keokuk, Iowa; Monroe and Cooper counties, Missouri.

Obs. Specimens of this species in Professor Hall's collection seen by the writer do not show a punctate shell structure, but are distinctly fibrous.

Seminula persinuata (Meek). Carboniferous.

Athyris (?) persinuata Meek, King's U. S. Geol. Expl. 40th Parl., IV, 1877, p. 81, pl. 9, fig. 4.

Loc. White Pine district, Nevada.

Seminula (?) plattensis (Swallow). Upper Carboniferous.

Spirigera plattensis Swallow, Trans. St. Louis Acad. Sci., II, 1863, p. 87.

Loc. Missouri; Kansas; Nebraska.

Seminula (?) rogersi Hall and Clarke. Upper Helderberg (Dev.).

Seminula rogersi Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pp. 97, 364, pl. 47, figs. 1–4.

Loc. Pendleton, Indiana.

Seminula singletonii (Swallow). Upper Carboniferous.

Spirigera singletonii Swallow, Trans. St. Louis Acad. Sci., II, 1863, p. 87.

Loc. Boone and Audrain counties, Missouri.

Obs. Probably a synonym for Seminula argentea.

Seminula subquadrata Hall. Kaskaskia (L. Carb.).

Athyris subquadrata Hall, Geol. Survey Iowa, I, Pt. II, 1858, p. 703, pl. 27, fig. 2, woodcut p. 708.—Whitfield, Annals N. Y. Acad. Sci., V, 1891, p. 585, pl. 14, figs. 1-3;—Geol. Ohio, VII, 1895, p. 472, pl. 10, figs. 1-3.—Keyes, Geol. Survey Missouri, V, 1895, p. 92.

Athyris subquadrata? Hall and Whitfield, King's U. S. Geol. Expl. 40th Parl., IV, 1877, p. 271, pl. 5, figs. 19, 20.

Seminula subquadrata Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 95, pl. 47, figs. 7-9, 15, 16; pl. 84, figs. 30, 31.

Loc. Chester, Illinois; Crittenden County, Kentucky; Newtonville and Maxville, Ohio; Oquirrh Mountains, Utah.

Obs. See Cleiothyris clintonensis.

Seminula titicacaensis (Gabb). Upper Carboniferous.

Terebratula titicacensis Gabb, Jour. Acad. Nat. Sci. Philadelphia, 2d ser., VIII, 1881, p. 302, pl. 42, fig. 11.

Loc. Lake Titicaca, Bolivia.

Seminula trinucleus Hall. St. Louis (L. Carb.).

Terebratula trinucleus Hall, Trans. Albany Institute, IV, 1858, p. 7;—Geol. Survey Iowa, I, Pt. II, 1858, p. 659, pl. 23, figs. 4, 5.

Athyris trinuclea Whitfield, Bull. American Mus. Nat. Hist., I, 1882, p. 50, pl. 6, figs. 22-27.—Hall, Twelfth Rep. State Geol. Indiana, 1883, p. 329, pl. 29, figs. 22-27.

Seminula trinuclea Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pp. 94, 95, fig. 65; pl. 47, figs. 5, 6, 10-14.

Loc. Bloomington and Spergen Hill, Indiana; Alton, Illinois; Boonville, Missouri; Princeton, Kentucky.

Obs. See Cleiothyris reflexa.

Seminula wasatchensis (White). Upper Carboniferous.

Rhynchonella wasatchensis White, Wheeler's Expl. and Survey west of 100th Meridian, Prel. Rep. 1874, p. 19;—Ibidem, Final Rep., 1875, p. 130, pl. 9, fig. 3.

Loc. Wasatch Range, near Provo, Utah.

Obs. Is related to S. subtilita. The great anterior thickening is due to old age.

Sieberella Œhlert, and Hall and Clarke=Gypidula.

Obs. It may prove that Sieberella will be useful as a subgenus of Gypidula.

SIPHONOTRETA de Vern. Genotype Crania unguiculata Eichwald.

Siphonotreta de Verneuil, Géol. de la Russie d'Europe et des Mont. de l'Oural, II, 1845, p. 286.—Dall, Bull. U. S. Nat. Mus., 8, 1877, p. 62.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 110, 167.—Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 358.—Hall and Clarke, Eleventh Ann. Rep. N. Y. State Geologist, 1894, p. 252.

Siphonotreta (?) micula McCoy. Calciferous (Ord.).

Siphonotreta? micula Ami, Rep. Progress Geol. Nat. Hist. Survey Canada for 1887-88, 1889, p. 52K.

Loc. Great Britain; near Laevis, Canada.

Siphonotreta (?) minnesotaensis Hall and Clarke. Trenton (Ord.).

Siphonotreta? minnesotensis Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 112, 177, pl. 4, figs. 37, 38.—Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 358, pl. 29, figs. 23, 24.

Loc. Minneapolis, Minnesota.

Siphonotreta scotica Whiteaves=Schizambon? fissus americanus.

SPHÆROBOLUS Matthew. Genotype Lingulella? spissa Billings.

Sphærobolus Matthew, Trans. Royal Soc. Canada, 2d ser., I, 1896, p. 283.

Sphærobolus spissus (Billings). Lower Ordovician.

Lingulella ? spissa Billings, Canadian Nat. Geol., n. ser., VI, 1872, p. 468, fig. 5;—Pal. Fossils, II, 1874, p. 67, fig. 36.

Sphærobolus spissus Matthew, Trans. Royal Soc. Canada, 2d ser., I, 1896, p. 263, pl. 1, fig. 5.

Loc. Bell Island, Newfoundland.

SPIRIFER Sowerby. Genotype Anomites striatus Martin.

Spirifer Sowerby, Mineral Conchology, II, 1815, p. 41.—Billings, Canadian Nat. Geol., I, 1856, p. 134.—Meek and Hayden, Pal. Upper Missouri, Smithsonian Cont. to Knowledge, XIV, 172, 1864, p. 17.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pp. 1–40;—Thirteenth Ann. Rep. N. Y. State Geologist, 1895, p. 751.

Spirifera Billings, Canadian Journal, VI, 1861, p. 253.—Hall, Twentieth Rep. N. Y. State Cab. Nat. Hist., 1867, p. 251;—Pal. New York, IV, 1867, p. 186.—White, Wheeler's Expl. and Survey west of the 100th Merid., 1875, p. 90.—Herrick, Bull. Denison University, IV, 1888, p. 14.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 105.—Hall, Bull. Geol. Soc. America, I, 1890, p. 567;—Ninth Ann. Rep. N. Y. State Geol., 1890, p. 9.

Spirifer acanthopterus (Conrad). ? Hamilton (Dev.).

Delthyris acanthoptera Conrad, Jour. Acad. Nat. Sci. Philadelphia, VIII, 1842, p. 264.

Loc. Oneonta, Otsego County, New York.

Spirifer acuminatus (Conrad). Corniferous and Hamilton (Dev.).

Delthyris acuminata Conrad, Third Ann. Rep. N. Y. Geol. Survey, 1839, p. 65.

Delthyris prora Conrad, Jour. Acad. Nat. Sci. Philadelphia, VIII, 1842, p. 263.

Terebratula acuminatissima Castelnau, Essai Syst. Silurien l'Amérique Septentrionale, 1843, p. 40, pl. 14, fig. 16.

Spirifer cultrijugatus Yandell and Shumard (non Roemer, 1844), Cont. Geol. Kentucky, 1847, p. 10.

Spirifer acuminata Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 135.

Spirifera acuminata Hall, Pal. New York, IV, 1867, pp. 198, 234, pl. 29, figs. 9–18; pl. 35, fig. 24.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 105, pl. 8, figs. 1–8.

Spirifer acuminatus White, Second Rep. Indiana Bureau of Statistics and Geol., 1880, p. 503, pl. 4, figs. 1–3;—Tenth Rep. State Geol. Indiana, 1881, p. 135, pl. 4, figs. 1–3.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pp. 31, 39, pl. 39, figs. 39–42.

Loc. Schoharie, Williamsville, Clarence Hollow, Hamilton, Madison, etc., New York; Columbus and Sandusky, Ohio; Falls of Ohio.

Spirifer acuticostatus de Koninck. Upper Carboniferous.

Spirifer acuticostatus de Koninck, Animaux Fos. Carb. Belgique, p. 265, pl. 17, fig. 6.

Spirifera acuticostata Davidson, Quart. Jour. Geol. Soc. London, XIX, 1863, p. 171, pl. 9, figs. 7, 8.—Dawson, Acadian Geol., 3d ed., 1878, p. 292, fig. 91.

Loc. Europe; Brookfield and Shubenacadie, Nova Scotia.

Spirifer agelaius Meek. Lower Carboniferous.

Spirifer triradialis? Meek (non Phillips), Sixth Ann. Rep. U. S. Geol. Survey Terr., 1873, p. 470.

Spirifer agelaius Meek, Ibidem, 1873, p. 470, footnote.—White, Twelfth Ann. Rep. U. S. Geol. Survey Terr., 1883, p. 135, pl. 34, fig. 10.

Loc. Near Virginia City, Montana.

Spirifer alatus Castelnau (non Schlotheim)=Spirifer aliformis.

Spirifer aliformis de Verneuil. Upper Helderberg (Dev.).
Spirifer alatus Castelnau (non Schlotheim), Essai Système Silurien l'Amérique Septentrionale, 1843, p. 42, pl. 12, fig. 4.
Spirifer alæformis de Verneuil, Ibidem, 1843, p. 42, footnote.
Loc. Schoharie, New York.
Obs. Compare with Spirifer arenosus.

Spirifer alba-pinensis Hall and Whitfield. Kinderhook (L. Carb.).
Spirifera albapinensis Hall and Whitfield, King's U. S. Geol. Expl., 40th Parl., IV, 1877, p. 255, pl. 4, figs. 7, 8.
Loc. Wasatch Range, Utah.
Obs. Appears to be a synonym of S. centronatus.

Spirifer aldrichi Etheridge. Devonian.
Spirifer aldrichi Etheridge, Quart. Jour. Geol. Soc. London, XXXIV, 1878, p. 634, pl. 29, fig. 2.
Loc. Dana Bay, lat. 82° 42′.

Spirifer alta Hall=Cyrtia alta.

Spirifer amarus Swallow. Hamilton (Dev.).
Spirifer amarus Swallow, Trans. St. Louis Acad. Sci., I, 1860, p. 642.
Loc. On page 658 it is given as Callaway County, Missouri, in association with Hamilton terrane fossils. It is probably the same as S. annæ Swallow.

Spirifer angustus Hall. Hamilton and Portage (Dev.).
Spirifer angusta Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 164, fig. in text.
Spirifera angusta Hall, Pal. New York, IV, 1867, p. 230, pl. 38A, figs. 23–32.—Whitfield, Geol. Wisconsin, IV, 1882, p. 329, pl. 26, fig. 3.—Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 54, figs. 14–17.
Spirifer angustus Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pp. 31, 39, pl. 24, figs. 14–17.
Loc. Livingston and Genesee counties, and Ithaca, New York; Portage group of New York (Williams); Milwaukee, Wisconsin.

Spirifer annæ Swallow. Hamilton (Dev.).
Spirifer annæ Swallow, Trans. St. Louis Acad. Sci., I, 1860, p. 641.
Loc. Callaway County, Missouri.
Obs. See S. amarus.

Spirifer annectans Walcott. Lower Carboniferous.
Spirifera annectans Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 216, pl. 18, fig. 7.
Loc. Eureka district, Nevada.

Spirifer antarcticus Morris and Sharpe. Lower Devonian.
Spirifer antarcticus Morris and Sharpe, Quart. Jour. Geol. Soc. London, II, 1846, p. 276, pl. 11, fig. 2.
Loc. Falkland Islands.
Obs. Compare with S. boliviaensis, S. chuquisaca, and S. orbignyi.

Spirifer arata Hall=Spirifer granulosus.

Spirifer arcticus Houghton. Devonian.
Spirifer arcticus Houghton, Jour. Royal Dublin Soc., I, 1857, p. 183.
Obs. The writer has not seen this journal.

Spirifer arctisegmentum Hall. Upper Helderberg (Dev.).
Spirifer arctisegmenta Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 131.
Spirifera arctisegmenta Hall, Pal. New York, IV, 1867, p. 208, pl. 31, figs. 9, 10;—

Spirifer arctisegmentum Hall—Continued.

Second Ann. Rep. N. Y. State Geol., 1883, pl. 59, figs. 10–12.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 108, pl. 12, figs. 14, 15.

Spirifer arctisegmentus Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 36, pl. 34, figs. 10–12.

Loc. Stafford and Genesee counties, New York; Falls of Ohio.

Spirifer arenosus (Conrad). Oriskany and Corniferous (Dev.).

Delthyris arenosa Conrad, Third Ann. Rep. N. Y. Geol. Survey, 1839, p. 65.—Mather, Geol. N. Y.; Rep. First Dist., 1843, p. 342, fig. 1.—Hall, Ibidem, Rep. Fourth Dist., 1843, p. 148, fig. 1.

Delthyris arenaria Vanuxem, Geol. N. Y.; Rep. Third Dist., 1842, p. 123, fig. 1; p. 124, fig. 5.

Spirifer arenosa Rogers, Geol. Pennsylvania, II, Pt. II, 1858, p. 826, fig. 650.—Hall, Pal. New York, III, 1859, p. 425, pl. 98, figs. 1–8; pl. 99, figs. 1–10; pl. 100, figs. 1–8.

Spirifera arenosa Billings, Geol. Canada, 1863, p. 960, fig. 465.—Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 55, figs. 3–7.

Spirifera unica Hall, Pal. New York, IV, 1867, p. 203, pl. 30, fig. 21; pl. 55, fig. 8.

Spirifer arenosus Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pp. 24, 27, 37, pl. 29, figs. 1–4; pl. 30, figs. 3–8.

Loc. Schoharie, Clarence Hollow, etc., New York; Cumberland, Maryland; Virginia; Frankstown, Pennsylvania; Cayuga, Ontario.

Spirifer argentarius Meek=Spirifer pinonensis.

Spirifer arrectus Hall=Spirifer murchisoni.

Spirifer asper Hall. Hamilton (Dev.).

Spirifer aspera Hall, Geol. Survey Iowa, I, Pt. II, 1858, p. 508, pl. 4, fig. 7.

Spirifera (Cyrtina) aspera Whitfield, Geol. Wisconsin, IV, 1882, p. 331, pl. 26, figs. 1, 2.

Spirifer asper Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pp. 29, 31, 32, 39, pl. 25, figs. 20–25.

Loc. Independence and Rockford, Iowa; Rock Island, Illinois; Milwaukee, Wisconsin; Canandaigua, New York.

Spirifer asperatus Ringueberg. Niagara (Sil.).

Spirifera asperata Ringueberg, Bull. Buffalo Soc. Nat. Sci., V, 1886, p. 16, pl. 2, fig. 5.

Loc. Lockport, New York.

Spirifer atwateranus Miller=Spirifer iowaensis.

Spirifer audaculus (Conrad). Marcellus and Hamilton (Dev.).

Delthyris audacula Conrad, Jour. Acad. Nat. Sci. Philadelphia, VIII, 1842, p. 262.

Delthyris medialis Hall, Geol. N. Y.; Rep. Fourth Dist., 1843, p. 208, fig. 8.—Rogers, Geol. Pennsylvania, II, Pt. II, 1858, p. 828, fig. 669.

Spirifer eatoni Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 157.

Spirifer medialis Hall, Ibidem, 1857, p. 164, fig. 1.

Spirifera medialis Hall, Pal. New York, IV, 1867, p. 227, pl. 38, figs. 1–25,—Second Ann. Rep. N. Y. State Geol., 1883, pl. 54, figs. 1–13.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 125, pl. 26, figs. 2–5.

Spirifera medialis var. eatoni Hall, Pal. New York, IV, 1867, pl. 38, figs. 12–18.

Spirifera audacula Whitfield, Geol. Wisconsin, IV, 1882, p. 329, pl. 25, figs. 25, 26.

Spirifer audaculus Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pp. 29–31, 39, pl. 24, figs. 1–13; pl. 29, fig. 5.

Loc. Otsego, Cayuga, Moscow, Darien, etc., New York; Falls of Ohio; Milwaukee, Wisconsin.

Spirifer audaculus macronotus Hall. Hamilton (Dev.).

Delthyris macronota Hall, Geol. N. Y.; Rep. Fourth Dist., 1843, p. 206, fig. 5.

Spirifera macronota Hall, Pal. New York, IV, 1867, p. 231, pl. 38A, figs. 1-22;—Second Ann. Rep. N. Y. State Geol., 1883, pl. 54, figs. 18-27.

Spirifer audaculus var. macronotus Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 24, figs. 18-27.

Loc. Bristol, Moscow, Darien, etc., New York.

Spirifer buarquianus Rathbun. Middle Devonian.

Spirifera buarquiana Rathbun, Proc. Boston Soc. Nat. Hist., XX, 1879, p. 28.

Loc. Rio Maecuru, Province of Para, Brazil.

Spirifer belphegor Clarke. Genesee (Dev.).

Spirifera belphegor Clarke, Bull. U. S. Geol. Survey, 16, 1885, p. 30, pl. 3, fig. 13.

Loc. Ontario County, New York.

Spirifer bicostatus Hall=Reticulara bicostata.

Spirifer bicostatus var. petilus Hall=Reticularia bicostata petila.

Spirifer bidorsalis Winchell. Hamilton (Dev.).

Spirifera bidorsalis A. Winchell, Geol. Rep. Lower Peninsula of Michigan, 1866, p. 93.

Loc. Grand Traverse district, Michigan.

Spirifer biforatus var. lynx Hall=Platystrophia biforata.

Spirifer bifurcatus Hall=Spirifer leidyi.

Spirifer billingsanus Miller. Oriskany (Dev.).

Spirifera superba Billings (non Eichwald), Pal. Fossils, II, 1874, p. 45, pl. 3A, fig. 3.

Spirifera billingsana Miller, N. American Geol. Pal., 1889, p. 372.

Loc. Indian Cove, Gaspé.

Spirifer bilobus Hall=Bilobites bilobus.

Spirifer bimesialis Hall. Upper Devonian.

Spirifer bimesialis Hall, Geol. Survey Iowa, I, Pt. II, 1858, p. 507, pl. 4, fig. 6.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pp. 17, 36, pl. 34, figs. 23-26.

Spirifera bimesialis Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 59, figs. 23-26.

Loc. Independence, Iowa; Naples, New York (Clarke).

Spirifer biplicatus Meek (non Hall)=Spirifer centronatus.

Spirifer biplicatus Hall. Kinderhook (L. Carb.).

Spirifer biplicata Hall, Geol. Survey Iowa, I, Pt. II, 1858, p. 519, pl. 7, fig. 5.

Spirifera biplicata Herrick, Bull. Denison Univ., III, 1888, p. 45; IV, 1888, p. 25, pl. 2, fig. 8.

Spirifer biplicatus Herrick, Geol. Ohio, VII, 1895, pl. 15, fig. 8.

Loc. Burlington, Iowa; Quincy, Illinois; Richfield, etc., Ohio.

Spirifer boliviaensis d'Orbigny. Devonian.

Spirifer boliviensis d'Orbigny, Voyage dans l'Amérique Méridionale, Pal., 1842, p. 37, pl. 2, figs. 8, 9.

Loc. Cochabamba and Chuquisaca, Bolivia.

Obs. Compare with S. antarcticus and S. hawkinsi.

Spirifer boonensis Swallow. Upper Carboniferous.

Spirifer booensis Swallow, Trans. St. Louis Acad. Sci., I, 1860, p. 646.

Loc. Boone, Randolph, and Monroe counties, Missouri.

Obs. Regarded by Keyes as a synonym for S. rockymontanus.

Spirifer byrnesi Nettelroth. Hamilton (Dev.).

Spirifera byrnesi Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 109, pl. 10, figs. 1-5?, 31-34, 36-39.

Loc. Falls of Ohio.

Spirifer cameratus Derby (non Morton)=Spirifer condor.

Spirifer cameratus Morton. Upper Carboniferous.

Spirifer cameratus Morton, American Jour. Sci., XXIX, 1836, p. 150, pl. 2, fig. 3.—Hall, Pacific Railroad Reports, III, 1856, p. 102, pl. 2, figs. 9, 12;—Geol. Survey Iowa, I, Pt. II, 1858, p. 709, pl. 28, fig. 2.—Geinitz, Carbon und Dyas in Nebraska, 1866, p. 44.—Meek, Final Rep. U. S. Geol. Survey Nebraska, 1872, p. 183, pl. 6, fig. 12; pl. 8, fig. 15.—Meek and Worthen, Geol. Survey Illinois, V, 1873, p. 573, pl. 25, fig. 7.—Toula, Neues Jahrbuch f. Mineral., 1874, p. 240;—Sitzungsb. der Kais. Akad. der Wissen. zu Wien, 1875, p. 543.—White, Wheeler's Expl. Survey west 100th Meridian, IV, 1875, p. 132, pl. 10, fig. 1.—Newberry, Macomb's Rep. Expl. Exped. from Santa Fe to the Great Colorado River of the West, 1876, p. 138.—Meek, Simpson's Rep. Expl. Great Basin Terr. Utah, 1876, p. 353, pl. 2, fig. 3.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pp. 26, 38, pl. 32, figs. 9–15.

Spirifer meusebachanus Roemer, Kreidebildung Texas, 1852, p. 88, pl. 11, fig. 7.

Spirifer triplicatus Hall, Stansbury's Expl. Survey of the Valley of Great Salt Lake, Utah, 1852, p. 410, pl. 4, fig. 5.

Spirifer inequicostatus? Owen, Geol. Survey Wisconsin, Iowa, and Minnesota, 1852, p. 586, pl. 5, fig. 6. [See specimens in U. S. Nat. Mus., Cat. Invert. Foss., 17954.]

Spirifer fasiger Owen (non Keyserling), Ibidem, 1852, pl. 5, fig. 4.

Spirifer striatus var. triplicatus Marcou, Geol. N. America, 1858, p. 49, pl. 7, fig. 3.

Spirifer species Rogers, Geol. Pennsylvania, II, Pt. II, 1858, p. 833, fig. 694.

Spirifer camerata Meek and Hayden, Proc. Acad. Nat. Sci. Philadelphia, 1859, p. 27.

Spirifera camerata Newberry, Ives's Rep. Colorado River of the West, 1861, p. 127.—White, Second Ann. Rep. Indiana Bureau Statistics and Geol., 1880, p. 517, pl. 8, fig. 3;—Tenth Rep. State Geol. Indiana, 1881, p. 149, pl. 8, fig. 3.—Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 57, figs. 9–15.—White, Thirteenth Rep. State Geol. Indiana, 1884, p. 132, pl. 35, figs. 3–5.—Herrick, Bull. Denison Univ., II, 1887, p. 45, pl. 2, fig. 22.—Keyes, Proc. Acad. Nat. Sci. Philadelphia, 1888, p. 230;—Geol. Survey Missouri, V, 1895, p. 83, pl. 40, fig. 5.

Spirifera camerata var. kansasensis Swallow, Trans. St Louis Acad. Sci., II, 1867, p. 409.

Spirifer (Trigonotreta) camerata Meek, King's U. S. Geol. Expl. 40th Parl., IV, 1877, p. 91, pl. 9, fig. 2.

Loc. Putnam Hill, Ohio; throughout the Upper Carboniferous of North America; western side of Spitzbergen (Toula).

Obs. S. cameratus is often regarded as identical with S. striatus (Martin). The latter species, however, is closely and finely reticulated with concentric growth lines, while in S. cameratus the plications are crowded with small pustules arranged in radiating lines. See S. condor and S. striatus.

Spirifer cameratus var. kansasensis Swallow=Spirifer cameratus.

Spirifer cameratus percrassus Swallow. Upper Carboniferous.

Spirifer cameratus var. percrassus Swallow, Trans. St. Louis Acad. Sci., II, 1866, p. 409.

Loc. Missouri and Kansas.

Obs. Regarded by Keyes as a synonym for S. cameratus.

Spirifer capax Hall=Spirifer euryteines.
Spirifer canandaiguæ Hall and Clarke=Reticularia canandaiguæ.
Spirifer carteri Hall=Syringothyris carteri.
Spirifer carteri Meek (non Hall)=Syringothyris texta.
Spirifer catskillensis Emmons=Spirifer mesistrialis.
Spirifer cedarensis Owen=S. iowaensis.

Spirifer centronatus A. Winchell. Waverly (L. Carb.).

Spirifer centronatus A. Winchell, Proc. Acad. Nat. Sci. Philadelphia, 1865, p. 118.—White, Wheeler's Expl. Survey west 100th Merid., IV, 1875, p. 86, pl. 5, fig. 8.

Spirifera (Trigonotreta) biplicata (Hall??) Meek, Pal. Ohio, II, 1875, p. 290, pl. 14, fig. 5.

Spirifera centronata Hall and Whitfield, King's U. S. Geol. Expl. 40th Parl., IV, 1877, p. 254, pl. 4, figs. 5, 6.

Loc. Cuyahoga Falls, Ohio; Black Hills, South Dakota; Wasatch Range, Utah; Mountain Spring, Nevada; Yellowstone Park.

Obs. See S. alba-pinensis.

Spirifer chilensis Forbes=Spiriferina rostrata.

Spirifer chuquisaca A. Ulrich. Middle Devonian.

Spirifer chuquisaca A. Ulrich, N. Jahrb. f. Mineral., Beilageband, VIII, 1892, p. 65, pl. 4, figs. 19, 20.

Loc. Chahuarani, Tarabuco, etc., Bolivia.

Obs. Compare with S. boliviaensis and S. antarcticus.

Spirifer clarus Swallow=Reticularia clara.

Spirifer clavatulus McChesney. Burlington (L. Carb.).

Spirifera clavatula McChesney, New Pal. Fossils, 1861, p. 84;—Trans. Chicago Acad. Sci., I, 1868, p. 36, pl. 6, fig. 5.

Loc. Burlington, Iowa.

Spirifer clintoni Hall=Spirifer granulosus.
Spirifer clio Hall=Delthyris consobrina.
Spirifer compactus Meek=Reticularia fimbriata.

Spirifer concinnus Hall. Lower Helderberg (Dev.).

Spirifer concinna Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 60, figs. 1-3.

Spirifera concinna Hall, Pal. New York, III, 1859, p. 200, pl. 25, fig. 2; pl. 28, fig. 7;—Second Ann. Rep. N. Y. State Geol., 1883, pl. 55, figs. 1, 2.

Spirifer concinnus Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pp. 24, 27, 38, pl. 30, figs. 1, 2.

Loc. Helderberg Mountains, New York.

Spirifer condor d'Orbigny. Upper Carboniferous.

Spirifer condor d'Orbigny, Voyage dans l'Amérique Méridionale, Pal., 1842, p. 46, pl. 5, figs. 11-14.—Waagen, Palæontologica Indica, Ser. XIII, I, 1883, p. 514.

Spirifer striatus var. multicostatus Toula, Sitzungsb. der kais. Akad. der Wissensch. zu Wien, 1869, p. 3, pl. 1, figs. 2-4.

Spirifera camerata Derby (non Morton), Bull. Cornell Univ., I, 1874, p. 12, pls. 1, 2, 4, 5;—Bull. Mus. Comp. Zool., III, 1875, p. 279.

Loc. Bolivia; Bomjardim and Itaituba, Brazil; Yampopata and the Island of Titicaca, Bolivia; Pichis River, Peru.

Spirifer condor d'Orbigny—Continued.

Obs. "It has for a long time been considered a synonym of S. striatus and later of S. cameratus. It is distinct, however, from the former by the lamellose striæ of growth and from the latter by these as well by the nearly entire absence of bundling of the ribs" (Waagen).

Spirifer conradanus Miller=Reticularia fimbriata.

Spirifer consobrina d'Orbigny=Delthyris consobrina.

Spirifer consors A. Winchell. Hamilton (Dev.).

Spirifer consors A. Winchell, Geol. Rep. Lower Peninsula of Michigan, 1866, p. 93.

Loc. Grand Traverse district, Michigan.

Spirifer cooperensis Waagen=Reticularia cooperensis.

Spirifer corticosus Hall. Hamilton (Dev.).

Spirifer corticosa Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 160.

Spirifera corticosa Hall, Pal. New York, IV, 1867, p. 236.

Loc. Cumberland, Maryland.

Obs. Compare with S. granulosus.

Spirifer (?) costalis Castelnau. ?Upper Helderberg (Dev.).

Spirifer costalis Castelnau, Essai Systéme Silurien l'Amérique Septentrionale, 1843, p. 41, pl. 14, fig. 7.

Loc. Schoharie, New York.

Spirifer crispatus Hall and Clarke. Niagara (Sil.).

Spirifer crispatus Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, p. 360, pl. 36, figs. 9, 10.

Loc. "Maryland."

Spirifer crispus (Hisinger). Niagara and Coralline (Sil.).

Terebratula crispa Hisinger, Svenska Vet.-Akad. Handlingar, 1826, tab. 7, fig. 4.

Delthyris staminea Hall, Geol. N. Y.; Rep. Fourth Dist., 1843, p. 105, fig. 3.

Spirifer crispus Hall, American Jour. Sci., XX, 1849, p. 228;—Pal. New York, II, 1852, p. 262, pl. 54, fig. 3; p. 328, pl. 74, fig. 9.—Beecher and Clarke, Mem. N. Y. State Mus., I, 1889, p. 75, pl. 6, figs. 6, 7.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pp. 19, 20, 36, pl. 36, figs. 1–6.

Spirifera crispa Hall, Twenty-eighth Rep. N. Y. State Mus. Nat. Hist., 1879, p. 157, pl. 24, figs. 6–12, 19;—Eleventh Rep. State Geol. Indiana, 1882, p. 295, pl. 24, figs. 6–12, 19;—Second Ann. Rep. N. Y. State Geol., 1883, pl. 61, figs. 1–6.

Loc. Europe; Lockport, Lewiston, and Schoharie, New York; Hamilton and Arisaig, Nova Scotia (Ami); Ontario; Waldron, Indiana.

Spirifer crispus simplex Hall. Niagara (Sil.).

Spirifera crispa var. Hall, Trans. Albany Institute, IV, 1863, p. 212.

Spirifera crispa var. simplex Hall, Twenty-eighth Rep. N. Y. State Mus. Nat. Hist., 1879, p. 157, pl. 24, figs. 1–5;—Eleventh Rep. State Geol. Indiana, 1882, p. 296, pl. 24, figs. 1–5.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 111, pl. 17, figs. 36, 37.

Spirifer crispus var. simplex Beecher and Clarke, Mem. N. Y. State Mus., I, 1889, p. 75, pl. 6, figs. 4, 5.

Loc. Waldron, Indiana; Louisville, Kentucky.

Spirifer cultrijugatus Yandell and Shumard=Spirifer acuminatus.

Spirifer cumberlandiæ Hall. Oriskany (Dev.).

Spirifer cumberlandiæ Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 63;—Pal. New York, III, 1859, p. 421, pl. 96, fig. 9.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pp. 17, 36, pl. 33, figs. 16–23.

Spirifer cumberlandiæ Hall—Continued.

Spirifera cumberlandiæ Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 58, figs. 16–23.

Loc. Cumberland, Maryland.

Spirifer cuspidatus of American authors=Syringothyris carteri.

Spirifer cuspidatiformis Miller=Syringothyris texta.

Spirifer cyclopterus Hall. Lower Helderberg and Oriskany (Dev.).

Spirifer cycloptera Hall, Tenth Ann. Rep. N. Y. State Cab. Nat. Hist., 1857, p. 58;—Pal. New York, III, 1859, p. 199, pl. 25, fig. 1.

Spirifera cycloptera Billings, Geol. Canada, 1863, p. 957, fig. 457;—Pal. Fossils, II, 1874, p. 48, pl. 3A, fig. 4.—Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 61, figs. 12, 13.

Spirifer cyclopterus Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 36, pl. 36, figs. 12, 15.

Loc. Helderberg Mountains, New York; Gaspé and New Brunswick.

Spirifer cyrtinaformis Hall and Whitfield=Cyrtia cyrtiniformis.

Spirifer davisi Nettelroth. Hamilton (Dev.).

Spirifera davisi Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 112, pl. 12, figs. 1–4.

Loc. Falls of Ohio.

Spirifer deltoideus Herrick. Waverly (L. Carb.).

Spirifera deltoidea Herrick, Bull. Denison Univ., IV, 1888, p. 27, pl. 2, fig. 7.

Spirifer deltoideus Herrick, Geol. Ohio, VII, 1895, pl. 15, fig. 7.

Loc. Licking County, Ohio.

Spirifer desideratus Walcott. Lower Carboniferous.

Spirifera desiderata Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 217, pl. 7, fig. 8.

Loc. Eureka district, Nevada.

Spirifer disjunctus Sowerby. Chemung (Dev.).

Spirifera disjuncta Sowerby, Trans. Geol. Soc., 2d ser., V, 1840, pl. 53, fig. 8; pl. 54, figs. 12, 13.—Davidson, Mon. British Devonian Brach., Pal. Soc., 1864, p. 23, pl. 5, figs. 1–12; pl. 6, figs. 1–5.—Hall, Pal. New York, IV, 1867, p. 243, pl. 41, figs. 1–19; pl. 42, figs. 1–20;—Second Ann. Rep. N. Y. State Geol., 1883, pl. 55, figs. 14–17.—Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 134.—Whiteaves, Cont. Canadian Pal., I, 1891, p. 221, pl. 29, fig. 4.

Delthyris perlatus Conrad, Fifth Ann. Rep. N. Y. Geol. Survey, 1841, p. 54.

Delthyris chemungensis Conrad, Jour. Acad. Nat. Sci. Philadelphia, VIII, 1842, p. 263.

Delthyris prolata Vanuxem, Geol. N. Y.; Rep. Third Dist., 1842, p. 179, fig. 3.

Delthyris cuspidata Hall (non Martin), Geol. N. Y.; Rep. Fourth Dist., 1843, p. 270, fig. 1.—Rogers, Geol. Pennsylvania, II, Pt. II, 1858, p. 829, fig. 683.

Delthyris disjuncta? Hall, Geology N. Y.; Rep. Fourth Dist., 1843, p. 269, fig. 3.

Delthyris acanthota Hall, Ibidem, 1843, p. 270, fig. 2.

Delthyris inermis Hall, Ibidem, 1843, p. 270, fig. 4.

Spirifer disjunctus Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pp. 21, 24, 27, 37, 49, pl. 30, figs. 14, 15, 17.—Herrick, Geol. Ohio, VII, 1895, pl. 23, fig. 11.

Loc. Europe; New York; Pennsylvania; Eureka district, Nevada; Peace, Hay, and Liards rivers, Canada.

Spirifer disjunctus occidentalis Whiteaves. Upper Devonian.

Spirifera disjuncta var. occidentalis Whiteaves, Cont. Canadian Pal., I, 1891, p. 222, pl. 29, fig. 5.

Loc. Hay River, Canada.

Spirifer disjunctus sulcifer Hall and Clarke. Chemung (Dev.).

Spirifera disjunctus var. sulcifer Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, p. 361, pl. 30, fig. 16.

Loc. Near Olean, New York.

Spirifer disparilis Hall=Metaplasia disparilis.

Spirifer divaricatus Hall. Corniferous and Hamilton (Dev.).

Spirifer divaricata Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 133.

Spirifer venustus Hall, Thirteenth Rep. Ibidem, 1860, p. 82.

Spirifera divaricata Hall, Pal. New York, IV, 1867, p. 213, pl. 32, figs. 1–6.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 113, pl. 11, figs. 6–11; pl. 12, figs. 5–11.

Spirifer divaricatus Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pp. 24, 27, 39, pl. 38, figs. 15–17.

Loc. Schoharie, Stafford, Williamsville, York, etc., New York; Port Colborne, Canada; Falls of Ohio; Lebanon, Kentucky.

Obs. Compare with S. multicostatus Castelnau.

Spirifer dubius Hall=Pentamerella dubia.

Spirifer dubius Nettelroth. ?Niagara (Sil.).

Spirifera dubia Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 115, pl. 33, figs. 23, 24.

Loc. Louisville, Kentucky.

Spirifer duodenarius (Hall). Upper Helderberg (Dev.).

Delthyris duodenaria Hall, Geol. N. Y.; Rep. Fourth Dist., 1843, p. 171, fig. 5.

Spirifera duodenaria Billings, Canadian Jour., n. ser., V, 1861, p. 256, figs. 65–67;—Geol. Canada, 1863, p. 372, fig. 394.—Hall, Pal. New York, IV, 1867, p. 189, pl. 27, figs. 13–16; pl. 28, figs. 24–33;—Second Ann. Rep. N. Y. State Geol., 1883, pl. 58, figs. 8–13.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 114, pl. 12, figs. 12, 13, 16.

Spirifera duodenaria? Rathbun, Proc. Boston Soc. Nat. Hist., XX, 1879, p. 25.

Spirifer duodenarius Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pp. 19, 37, pl. 33, figs. 8–15.

Loc. New York, Ontario, Columbus, Ohio; Falls of Ohio; Rio Maecuru, Province of Para, Brazil.

Spirifer duplicatus Hall=Spirifer dupliplicatus.

Spirifer duplicicosta Phillips. Carboniferous.

Spirifer duplicicostus Phillips, Geol. Yorkshire, II, 1829, p. 218, pl. 10, fig. 1.

Spirifera duplicicosta Etheridge, Quart. Jour. Geol. Soc. London, XXXIV, 1878, p. 628.

Loc. Europe; Feilden Isthmus, lat. 82° 43′.

Spirifer dupliplicatus (Conrad). Hamilton (Dev.).

Delthyris dupliplicata Conrad, Jour. Acad. Nat. Sci. Philadelphia, VIII, 1842, p. 261, pl. 14, fig. 16.

Spirifera duplicata Hall, Pal. New York, IV, 1867, pp. 223, 236.

Loc. Near Smyrna, New York.

Obs. Compare with S. granulosus Conrad.

Spirifer eatoni Hall=Spirifer audaculus.

Spirifer elizæ Rathbun. Middle Devonian.

Spirifer elizæ (Hartt MS.) Rathbun, Bull. Buffalo Soc. Nat. Sci., I, 1874, p. 239, pl. 8, figs. 15, 21; pl. 9, fig. 22.

Spirifera elizæ Rathbun, Proc. Boston Soc. Nat. Hist., XX, 1879, p. 28.

Loc. Erere, Province of Para, Brazil.

Spirifer engelmanni Meek and Worthen (non Meek)=Spirifer worthenanus.

Spirifer engelmanni Meek. Middle Devonian.

Spirifera engelmanni Meek, Proc. Acad. Nat. Sci. Philadelphia, 1860, p. 308.—Simpson's Rep. Expl. Great Basin Terr. Utah, 1876, p. 346, pl. 1, fig. 1.—King's U. S. Geol. Expl. 40th Parl., IV, 1877, p. 41, pl. 3, fig. 3.

Loc. Neils Valley, Utah; White Pine district, Nevada.

Spirifer eudora Hall. Niagara (Sil.).

Spirifera eudora Hall, Annual Rep. Geol. Survey Wisconsin, 1861, p. 25;—Geol. Rep. Wisconsin, I, 1863, p. 69, pl. 5; p. 436;—Trans. Albany Inst., IV, 1863, p. 211;—Twentieth Rep. N. Y. State Cab. Nat. Hist., 1867, p. 370, pl. 13, figs. 5, 7;—Ibidem, Twenty-eighth Rep., 1879, p. 156, pl. 24, figs. 13–18;—Eleventh Rep. State Geol. Indiana, 1882, p. 294, pl. 24, figs. 13–18;—Second Ann. Rep. N. Y. State Geol., 1883, pl. 51, figs. 19–21, 29.

Spirifer eudora Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pp. 13, 35, pl. 21, figs. 19–21, 29.

Loc. Racine, Wisconsin; Waldron, Indiana; Louisville, Kentucky.

Spirifer euruteines Hall (non Owen)=S. fornacula.

Spirifer euruteines var. fornacula Hall=S. fornacula.

Spirifer euryteines Owen. Hamilton (Dev.).

Delthyris euruteines Owen, Rep. Geol. Expl. Iowa, Wisconsin, and Illinois, 1844, p. 69, pl. 12, fig. 9.

Spirifer euruteines Owen, Geol. Survey Wisconsin, Iowa, and Minnesota, 1852, p. 586, pl. 3, figs. 2, 6. [See specimens in U. S. Nat. Mus., Cat. Invert. Foss., 17924.]

Spirifer parryana Hall, Geol. Survey Iowa, I, Pt. II, 1858, p. 509, pl. 4, fig. 8.—Keyes, Geol. Surv. Missouri, V, 1895, p. 77, pl. 40, fig. 4.

Spirifer capax Hall, Geol. Survey Iowa, I, Pt. II, 1858, p. 520, pl. 7, fig. 7.

Spirifera parryana Billings, Canadian Jour., VI, 1861, p. 261, figs. 77, 78;—Geol. Canada, 1863, p. 386, fig. 422.—Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 52, figs. 8, 9.—Calvin, Bull. Lab. State Univ. Iowa, 1888, p. 19.

Spirifera fornacula Meek and Worthen (non Hall), Geol. Survey Illinois, III, 1868, p. 433, pl. 13, fig. 8.

Spirifera capax Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 52, figs. 15–17.

†Spirifera parryana Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 137, pl. 14, fig. 10.

Spirifer parryanus Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pp. 29, 31, 39, pl. 22, figs. 8, 9, 15–17.

Loc. Pine Creek and elsewhere in Iowa; Eureka district, Nevada; Bosanquet, Ontario, Canada.

Obs. Owen described this species in 1839, but it was not published until 1844. In 1841 Owen sent Professor Hall specimens from the Falls of the Ohio labeled S. euruteines. This species was again refigured in his report of 1852, where he cites the same localities as in 1844 (p. 32 last paragraph), adding Falls of Ohio and Columbus, Ohio. Professor Hall is correct in regarding the Ohio specimens as distinct from those of the Mississippi Valley, but is in error in thinking that figures 6–6b of the 1852 report are drawn from an Ohio Falls specimen. These figures are of the same specimen as of figure 9 of the 1844 report, which is from Pine Creek, Iowa. The type specimens are in the National Museum collection. Owen's figure 2 is the same species as Hall's S. capax, while his figure 6 is a small individual of S. parryana Hall. Professor Calvin has shown these two species to be identical. Therefore it follows that S. euryteines must be restricted to the specimens from the Mississippi Valley. For the specimens from the Falls of the Ohio S. fornaculus Hall will be the proper name.

Spirifer extenuatus Hall=Syringothyris extenuata.

Spirifer fasciger Owen (non Keyserling)=Spirifer cameratus.

Spirifer fastigatus Meek and Worthen (non Morton)=Spirifer mortonanus.

Spirifer fastigatus Morton. ?Lower Carboniferous.

Spirifer fastigatus Morton, American Jour. Sci., XXIX, 1836, p. 152, pl. 14, fig. 35.
Loc. Junior Furnace, Scioto County, Ohio.
Obs. Not recognizable.

Spirifer filicosta A. Winchell. Hamilton (Dev.).

Spirifera filicosta A. Winchell, Report Lower Peninsula of Michigan, 1866, p. 94.
Loc. Grand Traverse district, Michigan.

Spirifer (?) fimbriatus Morton Upper Carboniferous.

Spirifer fimbriatus Morton, American Jour. Sci., XXIX, 1836, p. 150, pl. 2, fig. 1.
Loc. Putnam Hill, Ohio.
Obs. Not recognizable.

Spirifer fimbriatus Hall=Reticularia fimbriata.

Spirifer fischeri Castelnau=Spirifer macropleura.

Spirifer foggi Nettelroth. Niagara (Sil.).

Spirifera foggi Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 117, pl. 32, figs. 28–31.
Loc. Louisville, Kentucky.

Spirifer forbesi Norwood and Pratten. Burlington (L. Carb.).

Spirifer forbesi Norwood and Pratten, Jour. Acad. Nat. Sci. Philadelphia, III, 1854, p. 73, pl. 9, fig. 3.—Hall, Geol. Survey Iowa, I, Pt. II, 1858, p. 600, pl. 13, fig. 1.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pp. 26, 38, pl. 37, fig. 18.
Spirifera forbesi Keyes, Geol. Survey Missouri, V, 1895, p. 80, pl. 40, fig. 3.
Loc. Burlington, Iowa; Hannibal, Louisiana, and Sedalia, Missouri.

Spirifer formosus Hall. Hamilton (Dev.).

Spirifer formosa Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 154.
Spirifera formosa Hall, Pal. New York, IV, 1867, p. 220, pl. 28, figs. 12–16.
Loc. Bakeoven, Illinois.

Spirifer fornacula Meek and Worthen (non Hall)=Spirifer euryteines.

Spirifer fornacula Hall. Hamilton (Mid. Dev.).

Spirifer fornacula Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 154.
Spirifera euruteines Hall (non Owen), Pal. New York, IV, 1867, p. 209, pl. 31, figs. 14–19.—White, Second Ann. Rep. Indiana Bureau of Statistics and Geol., 1880, p. 504, pl. 4, figs. 4, 5;—Tenth Rep. State Geol. Indiana, 1881, p. 136, pl. 4, figs. 4, 5.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 115, pl. 6, figs. 1–7, 9, 11–17.
Spirifera euruteines var. fornacula Hall, Pal. New York, IV, 1867, p. 211, pl. 31, figs. 11–13.—Whitfield, Geol. Wisconsin, IV, 1882, p. 330, pl. 25, fig. 22.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 117, pl. 6, figs. 8, 10, 18–20.
Loc. Jackson County, Illinois; Falls of Ohio; Columbus, Ohio; Milwaukee, Wisconsin (Whitfield).
Obs. See remarks on S. euryteines Owen.

Spirifer fornax Hall. Hamilton (Dev.).

Spirifer fornax Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 155.
Loc. Illinois.

Spirifer franklini Meek=Reticularia franklini.

Spirifer fultonensis Worthen. Upper Carboniferous.

Spirifera fultonensis Worthen, Geol. Survey Illinois, V, 1873, p. 572, pl. 25, fig. 5.
Loc. Canton, Illinois.

Spirifer gaspensis Billings. Oriskany (Dev.).

Spirifera gaspensis Billings, Pal. Fossils, II, 1874, p. 44, pl. 3, fig. 8.
Loc. Gaspé.

Spirifer gibbosus Hall. Niagara (Sil.).

Spirifer gibbosus Hall, Ann. Rep. Geol. Survey Wisconsin, 1861, p. 25.
Spirifera gibbosa Hall, Twentieth Rep. N. Y. State Cab. Nat. Hist., 1867, p. 370, pl. 13, figs. 6, 8.
Loc. Racine, Wisconsin.
Obs. Probably the same as S. eudora Hall.

Spirifer glabrus Davidson=Martinia glabra.

Spirifer glabrus var. contractus Meek and Worthen=Martinia glabra contracta.

Spirifer glabrus nevadensis Walcott=Reticularia nevadaensis.

Spirifer glanscerasus White=Martinia glanscerasi.

Spirifer granuliferus Hall=Spirifer granulosus.

Spirifer granulosus (Conrad). Hamilton (Dev.).

Delthyris granulosa Conrad, Third Ann. Rep. Geol. Survey N. Y., 1839, p. 65.
Delthyris granulifera Hall, Geology N. Y.; Rep. Fourth Dist., 1843, p. 206, fig. 1.
Delthyris congesta Hall, Ibidem, 1843, p. 206, fig. 2.—Rogers, Geol. Pennsylvania, II, Pt. II, 1858, p. 828, figs. 670, 673.
Spirifer huroniensis Castelnau, Essai Système Silurien l'Amérique Septentrionale, 1843, p. 41, pl. 12, fig. 6.
Spirifer osteolatus Yandell and Shumard, Cont. Geol. Kentucky, 1847, p. 14.
Spirifer granulifera Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 163.
Spirifer arata Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 161.
Spirifer clintoni Hall, Ibidem, 1857, p. 157.
Spirifer oweni Hall, Ibidem, 1857, p. 129.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 22, figs. 1-7.
Spirifera oweni Hall, Pal. New York, IV, 1867, p. 197, pl. 29, figs. 1-8;—Second Ann. Rep. N. Y. State Geol., 1883, pl. 52, figs. 1-7.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 126, pl. 7, figs. 1-10.
Spirifera granulifera Hall, Pal. New York, IV, 1867, p. 223, pl. 36, figs. 1-13;—Second Ann. Rep. N. Y. State Geol., 1883, pl. 53, figs. 1-15.
Spirifera arata Hall, Pal. New York, IV, 1867, p. 225.
Spirifer granulosus Hall, Pal. New York, VIII, Pt. II, 1893, pp. 29, 30, 31, 38, pl. 23, figs. 1-15; pl. 29, figs. 9-12.
Loc. Schoharie, Moscow, Darien, Canandaigua, etc., New York; Pennsylvania; Cumberland, Maryland; Virginia; Falls of Ohio; Alpena, Michigan.

Spirifer gregarius Clapp. Upper Helderberg (Dev.).

Delthyris gregaria Yandell and Shumard, Cont. Geol. Kentucky, 1847, pp. 9, 10. (Nomina nudum.)
Spirifer gregaria (Clapp MS.) Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 127.
Spirifera gregaria Billings, Canadian Jour., n. ser., VI, 1861, p. 260, figs. 74-76;—Geol. Canada, 1863, p. 372, fig. 391.—Hall, Pal. New York, IV, 1867, p. 195, pl. 28, figs. 1-11.—White, Second Ann. Rep. Indiana Bureau of Statistics and Geol., 1880, pl. 4, figs. 10, 11;—Tenth Rep. State Geol. Indiana, 1881, p. 136, pl. 4, figs. 10, 11.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 119, pl. 8, figs. 9-13; pl. 10, figs. 6-10.

Spirifer gregarius Clapp—Continued.

Spirifer gregarius Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pp. 17, 36, pl. 29, fig. 7; pl. 37, figs. 11, 12.

Loc. Falls of Ohio; Columbus, Ohio; Genesee and Erie counties, New York; Ontario.

Spirifer grieri Hall. Upper Helderberg (Dev.).

Spirifer grieri Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 127;—Pal. New York, IV, 1867, p. 194, pl. 27, fig. 29; pl. 28, figs. 17–23.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pp. 24, 27, 38, pl. 30, figs. 9–13.

Spirifera grieri Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 55, figs. 9–13.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 120, pl. 9, figs. 8–14.

Loc. Clarence, Williamsville, etc., New York; Columbus, Ohio; Falls of Ohio.

Spirifer grimesi Hall. Kinderhook and Burlington (L. Carb.).

Spirifer grimesi Hall, Geol. Survey Iowa, I, Pt. II, 1858, p. 604, pl. 14, figs. 1–5.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pp. 23, 25, 38, pl. 31, figs. 8, 16–19.

Spirifer allied to grimesi Etheridge, Quart. Jour. Geol. Soc. London, XXXIV, 1878, p. 628, pl. 25, fig. 5.

Spirifera grimesi Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 56, figs. 8, 16–19.—Keyes, Geol. Survey Missouri, V, 1895, p. 79.

Loc. Burlington, Iowa; Quincy, Illinois; Fielden Isthmus, lat. 82° 43′; Hannibal, Louisiana, Sedalia, etc., Missouri.

Spirifer guadalupensis Shumard=Reticularia guadalupensis.

Spirifer hannibalensis Swallow=Syringothyris carteri.

Spirifer hartti Rathbun. Middle Devonian.

Spirifera hartti Rathbun, Proc. Boston Soc. Nat. Hist., XX, 1879, p. 29.

Loc. Rio Maecuru, Province of Para, Brazil.

Spirifer hawkinsi Morris and Sharpe. Lower Devonian.

Spirifer hawkinsii Morris and Sharpe, Quart. Jour. Geol. Soc. London, II, 1846, p. 276, pl. 11, fig. 1.

Loc. Falkland Islands.

Spirifer hemicyclus Meek and Worthen. Oriskany (Dev.).

Spirifer hemicyclus Meek and Worthen, Geol. Survey Illinois, III, 1868, p. 399, pl. 8, figs. 6, 7.

Loc. Union and Alexandria counties, Illinois.

Spirifer hemiplicatus Hall=Enteletes hemiplicatus.

Spirifer hesione Billings=Delthyris raricosta.

Spirifer hirtus White and Whitfield=Reticularia cooperensis.

Spirifer hobbsi Nettelroth. Hamilton (Dev.).

Spirifera varicosa var. Hall, Pal. New York, IV, 1867, p. 206, pl. 31, fig. 23.

Spirifera hobbsi Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 121, pl. 10, figs. 21, 22, 26–30, 35, 40.

Loc. Falls of Ohio.

Spirifer homfrayi Gabb=Spiriferina homfrayi.

Spirifer hungerfordi Hall. Chemung (Dev.).

Spirifer hungerfordi Hall, Geol. Survey Iowa, I, Pt. II, 1858, p. 501, pl. 4, fig. 1.—Tschernyschew, Mémoires du Comité Géologique de St. Petersbourg, III, 3, 1887, p. 62.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pp. 23, 25, 37, pl. 29, fig. 6; pl. 37, figs. 26–30.—Webster, American Naturalist, XXII, 1888, p. 1101.

Loc. Rockford, Iowa.

Spirifer huroniensis Castelnau=Spirifer granulosus.

Spirifer huronensis A. Winchell. Portage (Dev.).

Spirifer huronensis A. Winchell, Proc. Acad. Nat. Sci. Philadelphia, 1862, p. 406.
Loc. Port aux Barques, Michigan.

Spirifer imbrex Hall. Burlington (L. Carb.).

Spirifer imbrex Hall, Geol. Survey Iowa, I, Pt. II, 1858, p. 601, pl. 13, fig. 2.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pp. 26, 38, pl. 31, figs. 11, 12.
Spirifera imbrex Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 56, figs. 11, 12.
Loc. Burlington, Iowa; Hannibal and Louisiana, Missouri.

Spirifer inæquivalvis Castelnau=Rhynchotrema inæquivalvis.

Spirifer incertus Hall. Burlington (L. Carb.).

Spirifer incerta Hall, Geol. Survey Iowa, I, Pt. II, 1858, p. 602, pl. 13, fig. 3.
Loc. Burlington, Iowa.

Spirifer inconstans Hall=Spirifer nobilis.

Spirifer increbescens Hall. Kaskaskia (L. Carb.).

Spirifer increbescens Hall, Geol. Survey Iowa, I, Pt. II, 1858, p. 706, pl. 27, fig. 6.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pp. 27, 39, pl. 30, figs. 27–30; pl. 31, figs. 1–3.—Keyes, Geol. Survey Missouri, V, 1895, p. 82.
Spirifera increbescens Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 55, figs. 27–30; pl. 56, figs. 1–3.
Loc. Kaskaskia and Chester, Illinois; Kentucky.
Obs. Not synonymous with S. bisulcatus Sowerby, as stated by Meek and Safford. It has also been referred to S. trigonalis (Martin).

Spirifer increbescens americanus Swallow. Kaskaskia (L. Carb.).

Spirifer increbescens var. americana Swallow, Trans. St. Louis Acad. Sci., II, 1866, p. 410.
Loc. Illinois and Missouri.
Obs. Regarded by Keyes as a synonym for S. increbescens.

Spirifer increbescens transversalis Hall. Kaskaskia (L. Carb.).

Spirifer increbescens var. transversalis Hall, Geol. Survey Iowa, I, Pt. II, 1858, p. 708, pl. 27, fig. 6.
Loc. Kaskaskia and Chester, Illinois.

Spirifer inequicostatus Owen=Spirifer cameratus.

Spirifer insolitus Winchell=Martinia ? insolita.

Spirifer intermedius Hall. Oriskany (Dev.).

Spirifer intermedia Hall (non Brongniart, 1829), Pal. New York, III, 1859, p. 424.
Loc. Cumberland, Maryland.

Spirifer inutilis Hall. Upper Devonian.

Spirifer inutilis Hall, Geol. Survey Iowa, I, Pt. II, 1858, p. 505, pl. 4, fig. 4.
Spirifera inutilis Whiteaves, Cont. Canadian Pal., I, 1891, p. 223.
Loc. Independence, Iowa; Athabasca River, Canada.

Spirifer iowaensis Owen. Middle Devonian.

Spirifer iowensis Owen, Geol. Survey Iowa, Winconsin, and Minnesota, 1852, p. 585, pl. 3, fig. 1. [See specimens in U. S. Nat. Mus., Cat. Invert. Foss., 17925.]
Spirifer pennatus Owen (non Atwater), Ibidem, 1852, p. 585, pl. 3, figs. 3, 8. [Ibidem, Cat., 17919, 17920.]
Spirifer ligus Owen, Ibidem, 1852, p. 585, pl. 3, fig. 4, and pl. 3A, fig. 2 [Ibidem, Cat., 17921, 17922].—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pp. 31, 39, pl. 22, figs. 19–24; pl. 29, fig. 13.—Keyes, Geol. Survey Missouri, V, 1895, p. 77.

Spirifer iowaensis Owen—Continued.

Spirifer cedarensis Owen, Geol. Survey Iowa, Wisconsin, and Minnesota, 1852, p. 586, pl. 3, fig. 5. [See specimens in U. S. Nat. Mus., Cat. Invert. Foss., 17923.]

Spirifer pennata Hall, Geol. Survey, Iowa, I, Pt. II, 1858, p. 510, pl. 5, fig. 1.

?Spirifera allied to pennata Etheridge, Quart. Jour. Geol. Soc. London, XXXIV, 1878, p. 633, pl. 29, fig. 1.

Spirifera atwaterana Miller, Proc. Davenport Acad. Sci., 1878, p. 222.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 107.

Spirifera pennata Whitfield, Geol. Wisconsin, IV, 1882, p. 330, pl. 26, fig. 4.—Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 52, figs. 19–24.

Loc. New Buffalo, Independence, etc., Iowa; Rock Island, Illinois; Milwaukee, Wisconsin; Falls of Ohio; south of Cape Joseph Henry, lat. 82° 42′.

Obs. Owen's type specimens of S. iowaensis, S. pennatus, S. ligus, and S. cedarensis are preserved in the National Museum collection. The six specimens of these species show, when compared with a large series of similar shells from Iowa, that they are but variations of a very variable and widely distributed Spirifer of the Devonian of the Mississippi Valley. The width and degree of curvature of the ventral area and the length of the cardinal line are extremely variable features in S. iowaensis. Upon these characters Owen has based his species. The name S. iowaensis has been selected not only because it is very appropriate but also since it is the first one described. S. parryanus is another closely allied species, but can be separated generally by its wider ventral area and in the cardinal lines not being drawn out into more or less mucronate extensions.

Spirifer kelloggi Swallow. Keokuk (L. Carb.).

Spirifera kelloggi Swallow, Trans. St. Louis Acad. Sci., II, 1863, p. 86.—Keyes, Geol. Survey Missouri, V, 1895, p. 81.

Spiriferina kelloggi Safford, Geol. Tennessee, 1869, p. 360.

Loc. Keokuk, Iowa; Tennessee.

Spirifer kennicotti Meek. Middle Devonian.

Spirifer kennicotti Meek, Trans. Chicago Acad. Sci., I, 1868, p. 101, pl. 14, fig. 9.

Loc. Mackenzie River Valley, Northwest Territory, Canada.

Obs. This species is much like S. pennatus Miller, but with the fold and sinus plicated. It is unlike S. disjunctus, to which it has been referred by Whiteaves, in its shallow visceral cavity.

Spirifer kentuckiensis Shumard=Spiriferina cristata.

Spirifer kentuckiensis var. propatula Swallow=Spiriferina cristata.

Spirifer keokuk Hall. Keokuk (L. Carb.).

Spirifer striatus? var. attenuatus? Owen (non Sow.), Geol. Survey Wisconsin, Iowa, Minnesota, 1852, pl. 3A, fig. 8. [See specimens in U. S. Nat. Mus., Cat. Invert. Foss., 17944.]

Spirifer keokuk Hall, Geol. Survey Iowa, I, Pt. II, 1858, p. 642, pl. 20, figs. 3 and 2d;—Second Ann. Rep. N. Y. State Geol., 1883, pl. 55, figs. 21–24.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pp. 27, 38, pl. 30, figs. 21–24; pl. 37, figs. 13–15.

Spirifer keokuk var. Hall, Geol. Survey Iowa, I, Pt. II, 1858, p. 676, pl. 24, fig. 4.

Spirifer keokuk? Meek, Bull. U. S. Geol. Geogr. Survey Terr., II, 1876, p. 355, pl. 1, fig. 3.

Spirifera keokuk Keyes, Geol. Survey Missouri, V, 1895, p. 81, pl. 40, fig. 2.

Loc. Keokuk, Iowa; Nauvoo and Warsaw, Illinois; Utah; Rushville and Loudonville, Ohio (Herrick).

Obs. See S. littoni.

Spirifer keokuk shelbyensis Swallow. Warsaw (L. Carb.).

Spirifer keokuk var. shelbyensis Swallow, Trans. St. Louis Acad. Sci., II, 1866, p. 410.

Loc. Shelby County, Missouri.

Spirifer knappanus Nettelroth=Reticularia knappiana.

Spirifer lateralis Hall. Warsaw (L. Carb.).

Spirifer lateralis Hall, Geol. Survey Iowa, I, Pt. II, 1858, p. 661, pl. 23, fig. 7.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 32, figs. 1–3; pl. 37, fig. 19.

? Spirifera lateralis Hall, Second Ann. Rep. N. Y. State Geol., 188', pl. 57, figs. 1–3.

Loc. Clifton and Warsaw, Illinois.

Spirifer latior Swallow. Chouteau (L. Carb.).

Spirifer latior Swallow, Trans. St. Louis Acad. Sci., II, 1863, p. 86.

Loc. Cooper County, Missouri.

Obs. Compare with S. marionensis.

Spirifer lævigatus Swallow=Martinia lævigata.

Spirifer lævis Hall=Reticularia lævis.

Spirifer laminosus Geinitz (non McCoy)=Spiriferina cristata.

Spirifer leidyi Norwood and Pratten. St. Louis (L. Carb.).

Spirifer leidyi Norwood and Pratten, Jour. Acad. Nat. Sci. Philadelphia, III, 1854, p. 72, pl. 9, fig. 2.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pp. 27, 39, pl. 30, figs. 25, 26.

Spirifer bifurcatus Hall, Trans. Albany Institute, IV, 1857, p. 8.

Spirifera bifurcata Whitfield, Bull. American Mus. Nat. Hist., I, 1882, p. 47, pl. 6, figs. 13–15.—Hall, Twelfth Rep. State Geol. Indiana, 1883, p. 326, pl. 29, figs. 13–15.

Spirifera leidyi Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 55, figs. 25, 26.—Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 216, pl. 18, fig. 4.—Keyes, Geol. Survey Missouri, V, 1895, p. 82.

Loc. Chester, Illinois; Spergen Hill, Indiana; Princeton, Kentucky; Utah; Eureka district, Nevada.

Spirifer leidyi chesterensis Swallow. Kaskaskia (L. Carb.).

Spirifer leidyi var. chesterensis Swallow, Trans. St. Louis Acad. Sci., II, 1866, p. 409.

Loc. "Above the St. Louis limestone," Missouri.

Obs. Regarded by Keyes as a synonym for S. leidyi.

Spirifer leidyi merimacensis Swallow. Warsaw (L. Carb.).

Spirifer leidyi var. merimacensis Swallow, Trans. St. Louis Acad. Sci., II, 1866, p. 410.

Loc. Barrets Station, St. Louis County, Missouri.

Obs. Regarded by Keyes as a synonym for S. leidyi.

Spirifer ligus Owen=S. iowaensis.

Spirifer lineatoides Swallow=Reticularia pseudolineata.

Spirifer lineatus of American authors=Reticularia perplexa.

Spirifer lineatus striatolineatus Swallow=Reticularia perplexa striatilineata.

Spirifer linguiferoides Forbes=Spiriferina rostrata.

Spirifer littoni Swallow. St. Louis (L. Carb.).

Spirifer littoni Swallow, Trans. St. Louis Acad. Sci., I, 1860, p. 646.

Loc. St. Louis County, Missouri.

Obs. Regarded by Keyes as a synonym for S. keokuk.

Spirifer logani Hall. Keokuk (L. Carb.).

Spirifer logani Hall, Geol. Survey Iowa, I, Pt. II, 1858, p. 647, pl. 20, fig. 7; pl. 21, figs. 1, 2.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pp. 25, 38, pl. 32, figs. 7, 8.

Spirifera logani A. Winchell, Proc. American Phil. Soc., XII, 1870, p. 245.—Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 57, figs. 7, 8.—Keyes, Geol. Survey Missouri, V, 1895, p. 81.

Loc. Nauvoo, Illinois; Clark County, Missouri; Tennessee.

Spirifer lyelli de Verneuil=Spirifer pennatus.

Spirifer macbridei Calvin. Upper Devonian.

Spirifera macbridei Calvin, American Jour. Sci., 3d ser., XXV, 1883, p. 433.—Calvin, Bull. Lab. Nat. Hist. State Univ. Iowa, II, 1892, p. 166, pl. 12, fig. 3.

Spirifer macbridii Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pp. 29, 31, 39, pl. 25, figs. 9–16 (?17–19).

Loc. Rockford, Iowa.

Spirifer macconathei Nettelroth. Hamilton (Dev.).

Spirifera macconathii Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 123, pl. 11, figs. 1–5.

Loc. Falls of Ohio.

Spirifer macra Meek (non Hall)=Spirifer strigosus.

Spirifer macrus Hall. Upper Helderberg (Dev.).

Spirifer macra Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 134.

Spirifera macra Hall, Pal. New York, IV, 1867, p. 190, pl. 27, figs. 17–28;—Second Ann. Rep. N. Y. State Geol., 1883, pl. 59, figs. 1–3.

Spirifer macrus Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pp. 17, 36, pl. 34, figs. 1–3.

Loc. Schoharie, Williamsville, etc., New York; Columbus, Ohio.

Spirifer macronotus Hall=S. audaculus macronotus.

Spirifer macropleura (Conrad). Lower Helderberg (Dev.).

Delthyris macropleura Conrad, Fourth Ann. Rep. N. Y. Geol. Survey, 1840, p. 207.—Vanuxem, Geol. N. Y.; Rep. Third Dist., 1842, p. 120, fig. 1.—Mather, Ibidem, Rep. First Dist., 1843, p. 343, fig. 1.

Spirifer macropleurus Castelnau, Essai Système Silurien l'Amérique Septentrionale, 1843, p. 41, pl. 13, fig. 5.

Spirifer fischeri Castelnau, Ibidem, 1843, p. 42, pl. 13, fig. 4.

Spirifer macropleura Hall, Pal. New York, III, 1859, p. 202, pl. 27, fig. 1; pl. 28, fig. 8.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pp. 13, 35, pl. 20, figs. 22–24, 27.

Spirifera macropleura Billings, Geol. Canada, 1863, p. 957, fig. 456;—Proc. Portland Soc. Nat. Hist., 1863, p. 117, pl. 3, fig. 16.—Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 51, figs. 22–24, 27.

Loc. Schoharie, Carlisle, Catskill, etc., New York; Square Lake, Maine; Cumberland, Maryland; Perry County, Tennessee.

Spirifer macrothyris Hall. Upper Helderberg (Dev.).

Spirifer macrothyris Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 132.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pp. 29, 31, 39, pl. 23, figs. 16–18.

Spirifera macrothyris Hall, Pal. New York, IV, 1867, p. 202, pl. 30, figs. 16–20;—Second Ann. Rep. N. Y. State Geol., 1883, pl. 53, figs. 16–18.

Loc. Williamsville and Clarence Hollow, New York; Cayuga, Ontario; Columbus, Ohio.

Spirifer mæcuruensis Rathbun. Middle Devonian.

Spirifer mæcuruensis Rathbun, Proc. Boston Soc. Nat. Hist., XX, 1879, p. 30.

Loc. Rio Maecuru, Province of Para, Brazil.

Spirifer maius Billings=Martinia maia.

Spirifer manni Hall. Upper Helderberg (Dev.).

Spirifer manni Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 128.

Spirifera manni Hall, Pal. New York, IV, 1867, p. 211, pl. 31, figs. 20–30.

Loc. Sandusky and Columbus, Ohio; Williamsville, New York.

Spirifer marcoui Waagen. Upper Carboniferous.

Spirifer striatus Marcou (non Martin), Geol. North America, 1858, p. 49, pl. 7, fig. 2.

Spirifer marcoui Waagen, Palæontologica Indica, Ser. XIII, I, 1883, p. 510, pl. 47.

Loc. Shasta County, California; Tigeras, New Mexico; Vancouver Island.

Spirifer marcyi Hall. Hamilton (Dev.).

Spirifer marcyi Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 158, figs. 1, 2.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pp. 29, 39, pl. 22, figs. 10–14.

Spirifera marcyi Hall, Pal. New York, IV, 1867, p. 226, pl. 37, figs. 10–20;—Second Ann. Rep. N. Y. State Geol., 1883, pl. 52, figs. 10–14.

Loc. Covington; Cayuga and Seneca lakes, New York; Columbus, Ohio (Whitfield).

Spirifer marionensis Shumard. Chouteau (L. Carb.).

Spirifer marionensis Shumard, Geol. Rep. Missouri, 1855, p. 203, pl. C, fig. 8.—Hall, Geol. Survey, Iowa, I, Pt. II, 1858, p. 501, pl. 6, fig. 1.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pp. 25, 38, pl. 31, fig. 15.—Herrick, Geol. Ohio, VII, 1895, pl. 15, fig. 2.

Spirifera marionensis A. Winchell, Proc. American Phil. Soc., XII, 1870, p. 252.—Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 56, fig. 15.—Herrick, Bull. Denison Univ., III, 1888, p. 43, pl. 6, figs. 2–4; pl. 7, fig. 11; IV, 1888, p. 26, pl. 2, fig. 2.—Keyes, Geol. Surv. Missouri, V, 1895, p. 78.

? Spirifera marionensis Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 124.

Loc. Louisiana and Hannibal, Missouri; Portsmouth, Sciotoville, etc., Ohio; ? Falls of Ohio.

Obs. Compare with S. osagensis, S. missouriensis, and S. vernonensis.

Spirifer medialis Hall=Spirifer audaculus.

Spirifer meeki Swallow. Burlington (L. Carb.).

Spirifer meeki Swallow, Trans. St. Louis Acad. Sci., I, 1860, p. 645.

Loc. Pettis and Saline counties, Missouri.

Spirifer meristoides Meek=Martinia meristoides.

Spirifer mesacostalis Hall=Delthyris mesicostalis.

Spirifer mesistrialis Hall. Portage and Chemung (Dev.).

Delthyris mesastrialis Hall, Geol. N. Y.; Rep. Fourth Dist., 1843, p. 269, fig. 1.

Spirifer catskillensis Emmons, Manual of Geology, 1860, p. 151.

Spirifera mesastrialis Hall, Pal. New York, IV, 1867, p. 242, pl. 40, figs. 14–22, and p. 417.

Spirifer mesastrialis Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pp. 14, 35, pl. 37, figs. 4, 5.

Loc. Schoharie, Cortlandville, Cayuta Creek, and Ithaca, New York.

Spirifer metus Hall =Cyrtia meta.

Spirifer meusebachanus Roemer=Spirifer cameratus.

Spirifer mexicanus Shumard. Upper Carboniferous.

Spirifera Mexicana Shumard, Trans. St. Louis Acad. Sci., I, 1858, p. 292, pl. 11, fig. 4, and p. 390.

Loc. Guadalupe Mountains, New Mexico and Texas.

Spirifer missouriensis Swallow. Chouteau (L. Carb.).

Spirifer missouriensis Swallow, Trans. St. Louis Acad. Sci., I, 1860, p. 643.

Loc. Cooper County, Missouri.

Obs. Regarded by Keyes as a synonym for S. marionensis.

Spirifer modestus Hall=Reticularia modesta.

Spirifer mortonanus Miller. Keokuk (L. Carb.).

Spirifera fastigata Meek and Worthen (non Worthen), Proc. Acad, Nat. Sci. Philadelphia, 1870, p. 36;—Geol. Survey Illinois, VI, 1875, p. 521, pl. 30, fig. 3.

Spirifera mortonana Miller, American Pal. Fossils, 2d ed., 1883, p. 298.

Spirifer mortonanus Hall and Clarke, Pal, New York, VIII, Pt. II, 1893, pp. 26, 38, pl. 38, figs. 18, 19.

Loc. Crawfordsville, Indiana; Kings Mountain and Lebanon, Kentucky.

Spirifer mucronatus Conrad=Spirifer pennatus.

Spirifer multicostatus Castelnau. ?Corniferous (Dev.).

Spirifer multicostatus Castelnau, Essai Système Silurien l'Amérique Septentrionale, 1843, p. 42, pl. 12, fig. 3.

Loc. Schoharie, New York.

Obs. See S. divaricatus.

Spirifer multigranosus Worthen=Spirifer texasanus.

Spirifer multistriata Hall=Trematospira multistriata.

Spirifer mundulus Rowley. Burlington (L. Carb.).

Spirifera mundula Rowley, American Geologist, XII, 1893, p. 307, pl. 14, figs. 10–12.

Loc. Louisiana, Missouri.

Spirifer murchisoni Castelnau. Oriskany (Dev.).

Spirifer murchisoni Castelnau, Essai Système Silurien l'Amérique Septentrionale, 1343, p. 41, pl. 12, figs. 1, 2.

Spirifer arrecta Hall, Pal. New York, III, 1859, p. 422, pl. 97, figs. 1, 2.

Spirifera arrecta Billings, Geol. Canada, 1863, p. 960, fig. 466.—Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 58, figs. 24–27.

Spirifer sp. a A. Ulrich, N. Jahrb. f. Mineral., Beilageband, VIII, 1892, p. 67, pl. 4, fig. 22.

Spirifer arrectus Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pp. 17, 19, 37, pl. 33, figs. 24–27.

Loc. Schoharie and Albany counties, New York; Cumberland, Maryland; Cayuga, Ontario; near Totora, Bolivia.

Obs. Castelnau's figures prove conclusively that he was the first to describe this species.

Spirifer mysticensis Meek. Lower Carboniferous.

Spirifera mysticensis Meek, Sixth Ann. Rep. U. S. Geol. Survey Terr., 1873, p. 466.—Miller, North American Geol. and Pal., 1889, p. 374.

Loc. Outlet of Mystic Lake, Montana.

Spirifer neglectus Hall. Keokuk (L. Carb.).

Spirifer neglectus Hall, Geol. Survey Iowa, I, Pt. II, 1858, p. 643, pl. 20, fig. 5.

Spirifera neglecta Meek and Worthen, Geol. Survey Illinois, VI, 1875, p. 523, pl. 30, figs. 1c, 2a.—Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 217, pl. 18, fig. 10.

Spirifer neglectus Hall—Continued.

? Spirifera neglecta de Koninck, Annales du Musée Royal d'Historie Nat. de Belgique, XIV, 1887, p. 134, pl. 31, figs. 10–15.

Loc. Keokuk, Iowa; Warsaw and Nauvoo, Illinois; Eureka district, Nevada; ? Belgium.

Spirifer newberryi Hall. Waverly (L. Carb.).

Spirifera newberryi Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 56, figs. 9, 10.

Spirifer newberryi Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, p. 362, pl. 31, figs. 9, 10.

Loc. Northern Ohio.

Spirifer niagaraensis (Conrad). Niagara (Sil.).

Delthyris niagarensis Conrad, Jour. Acad. Nat. Sci. Philadelphia, VIII, 1842, p. 261.—Hall, Geol. N. Y.; Rep. Fourth Dist., 1843, p. 105, fig. 1.

Spirifer niagarensis Hall, Pal. New York, II, 1852, p. 264, pl. 54, fig. 5.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pp. 14, 35, pl. 21, figs. 1–4, 25; pl. 37, fig. 1.

Spirifera niagarensis Billings, Canadian Nat. Geol., I, 1856, p. 137, pl. 2, fig. 8;—Geol. Canada, 1863, p. 317, fig. 329.—Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 51, figs. 1–4, 25.

Loc. Lockport, Rochester, etc., New York; Osgood, Indiana.

Spirifer niagaraensis oligoptychus Roemer. Niagara (Sil.).

Spirifera niagarensis var. oligoptychus Roemer, Sil. Fauna West. Tennessee, 1860, p. 68, pl. 5, fig. 8.

Spirifer macropleurus Safford, Geol. Tennessee, 1869, p. 321.

Loc. Decatur County, Tennessee.

Obs. Compare with S. eudorus Hall and S. macropleurus Conrad.

Spirifer nictauvensis Dawson. Oriskany (Dev.).

Spirifera nictavensis Dawson, Acadian Geology, 3d ed., 1878, p. 499, fig. 176;—Canadian Nat. Geol., n. ser., IX, 1879, p. 3.

Loc. Near Nictaux, Nova Scotia.

Spirifer nobilis Barrande. Niagara (Sil.).

Spirifer nobilis Barrande, Ueber die Brach. der Sil. Schicht von Böhmen, 1847.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pp. 14, 35, pl. 29, fig. 16; pl. 37, figs. 2, 3.

Spirifer racinensis McChesney, New Pal. Fossils, 1861, p. 84.

Spirifer inconstans Hall, Ann. Rep. Geol. Survey Wisconsin, 1861, p. 26;—Geol. Rep. Wisconsin, I, 1862, p. 69, fig. 6; p. 436.

Spirifera nobilis Hall, Twentieth Rep. N. Y. State Cab. Nat. Hist., 1867, p. 372, pl. 13, figs. 14–16.

Spirifera racinensis McChesney, New Pal. Fossils, 1868, p. 84.

Loc. Racine, Wisconsin; Chicago, Illinois.

Spirifer norwoodana Hall=Spiriferina norwoodana.

Spirifer norwoodi Meek=Cyrtia norwoodi.

Spirifer nova-mexicanus Miller. Burlington (L. Carb.).

Spirifera novamexicana Miller, Jour. Cincinnati Soc. Nat. Hist., IV, 1881, p. 344, pl. 7, fig. 10.

Loc. Lake Valley mining district, New Mexico.

Spirifer nymphus Billings=Reticularia nympha.

Spirifer obtusus Gabb=Spiriferina obtusa.

Spirifer octocostatus Hall. Lower Helderberg (Dev.).

Spirifer octocostata Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 62;—Pal. New York, III, 1859, p. 205, pl. 28, fig. 4.

Loc. Cumberland, Maryland.

Spirifer octoplicatus Hall=Spiriferina cristata.

Spirifer opimus Hall=Spirifer rockymontanus.

Spirifer orbignyi Morris and Sharpe. Lower Devonian.

Spirifer orbignii Morris and Sharpe, Quart. Jour. Geol. Soc. London, II, 1846, p. 276, pl. 11, fig. 3.

Loc. Falkland Islands.

Obs. Probably identical with S. antarcticus.

Spirifer oregonensis Shumard. Upper Carboniferous.

Spirifer oregonensis Shumard, Trans. St. Louis Acad. Sci., II, 1863, p. 108.

Loc. Near Fort Filmore, New Mexico.

Spirifer orestes Hall and Whitfield. Chemung (Dev.).

Spirifera orestes Hall and Whitfield, Twenty-third Rep. N. Y. State Cab. Nat. Hist., 1872, p. 237, pl. 11, figs. 16–20.—Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 55, fig. 20.

Spirifer orestes Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pp. 27, 38, pl. 30, fig. 20.

Loc. Rockford, Iowa; Naples, New York.

Obs. Compare with S. strigosus.

Spirifer osagensis Swallow. Chouteau (L. Carb.).

Spirifer osagensis Swallow, Trans. St. Louis Acad. Sci., I, 1860, p. 641.

Loc. Pettis County, Missouri.

Obs. Regarded by Keyes as a synonym for S. marionensis.

Spirifer ovalis Phillips. Carboniferous.

Spirifer ovalis Phillips, Geol. Yorkshire, II, 1836, p. 219, pl. 10, fig. 5.—Etheridge, Quart. Jour. Geol. Soc. London, XXXIV, 1878, p. 629.

Loc. Europe. Feilden Isthmus, lat. 82° 43′.

Spirifer oweni Hall=Spirifer granulosus.

Spirifer paradoxus (Schlotheim). Corniferous (Dev.).

Terebratula paradoxa Schlotheim, Petrefactenkunde, VII, 1813, p. 249, tab. 2, fig. 6.

Spirifer paradoxus? Meek and Worthen, Geol. Survey Illinois, III, 1868, p. 415, pl. 10, fig. 2.

Loc. Europe; Union and Jackson counties, Illinois.

Spirifer parryana Hall=S. euryteines Owen.

Spirifer peculiaris Shumard. Kinderhook (L. Carb.).

Spirifer? peculiaris Shumard, Geol. Rep. Missouri, 1855, p. 202, Pl. C, fig. 7.

Spirifera (Martinia) peculiaris White, Wheeler's Expl. and Survey west 100th Meridian, IV, 1875, p. 90, pl. 5, fig. 7.

Loc. Cooper County, Missouri; Mountain Spring, Nevada.

Spirifer pedroanus Rathbun. Middle Devonian.

Spirifera pedroana (Hartt) Rathbun, Bull. Buffalo Soc. Nat. Sci., I, 1874, p. 237, pl. 8, figs. 1–9, 13, 14, 16–20;—Proc. Boston Soc. Nat. Hist., XX, 1879, p. 27.

Loc. Erere and Province of Para, Brazil.

Spirifer pennatus Owen=Spirifer iowaensis.

Spirifer pennatus (Atwater). Marcellus, Hamilton, and Chemung (Dev.).

Terebratula pennata Atwater, American Jour. Sci. Arts, II, 1820, p. 244, pl. 1, figs. 2, 3.

Delthyris mucronata Conrad, Fifth Ann. Rep. Geol. Survey New York, 1841, p. 54.—Vanuxem, Geol. N. Y.; Rep. Third Dist., 1842, p. 150, fig. 3.—Hall, Ibidem, Rep. Fourth Dist., 1843, p. 198, figs. 2, 3; p. 205, fig. 3 (non p. 270, fig. 3=S. pennatus posterus).—(Conrad) Hall, Fifteenth Rep. N. Y. State Cab. Nat. Hist., 1862, pl. 11, fig. 18.

Spirifer sowerbyi Castelnau, Essai Syst. Silurien l'Amérique Septentrionale, 1843, pl. 13, fig. 1 (non Fischer).

Spirifer lyelli de Verneuil, Ibidem, 1843, p. 43.

Spirifer mucronata Billings, Canadian Nat. Geol., I, 1856, p. 474, pl. 7, figs. 9, 10.—Rogers, Geol. Pennsylvania, II, 1858, p. 828, fig. 668.

Spirifera mucronata Billings, Canadian Jour., n. ser., VI, 1861, p. 254, figs. 59–62;—Geol. Canada, 1863, p. 386, fig. 424.—Hall, Pal. New York, IV, 1867, p. 216, pl. 34, figs. 1–32.—Nicholson, Pal. Prov. Ontario, 1874, p. 80.—Whitfield, Geol. Wisconsin, IV, 1882, p. 328, pl. 25, figs. 27, 28.—Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 59, figs. 13–22.—Calvin, American Geologist, I, 1888, p. 82.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 126, pl. 31, figs. 10, 11.

Spirifer mucronatus var. Williams, Bull. Geol. Soc. America, I, 1890, pl. 12, fig. 13.

Spirifer mucronatus Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pp. 14, 17, 36, pl. 29, fig. 8; pl. 34, figs. 13–22.

Loc. New York, Pennsylvania, Maryland, Virginia; Bosanquet, Ontario; Milwaukee, Wisconsin.

Obs. Atwater's specimen was found in the drift of Ohio. Mr. Miller is correct in regarding it the same as the well-known S. mucronatus.

Spirifer pennatus posterus Hall and Clarke. Chemung (Dev.).

Delthyris mucronata (partim) Hall, Geol. New York; Rep. Fourth Dist., 1843, p. 270, fig. 3.

Spirifer mucronatus var. posterus Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, p. 361, pl. 34, figs. 27-31.

Loc. Tompkins County, New York.

Spirifer pennatus tulliensis Williams. Tully (Dev.).

Spirifer mucronatus var. tulliensis Williams, Bull. Geol. Soc. America, I, 1890, p. 491, pl. 12, fig. 12.

Loc. Tinkers Falls, New York.

Spirifer pentlandi d'Orbigny. Carboniferous.

Spirifer pentlandi d'Orbigny, Voyage dans l'Amérique Méridionale, Pal., 1842, p. 48, pl. 5, figs. 15.

Loc. Lake Titicaca, Bolivia.

Spirifer perforata Hall=Trematospira perforata.

Spirifer perextensus Meek and Worthen. Corniferous (Dev.).

Spirifera perextensa Meek and Worthen, Geol. Survey Illinois, III, 1868, p. 414, pl. 10, fig. 1.

Loc. Near Jonesboro, Union County, Illinois.

Obs. Regarded by Keyes as a synonym for S. ligus=S. iowaensis.

Spirifer perlamellosus Hall=Delthyris perlamellosa.

Spirifer perplexus McChesney=Reticularia perplexa.

Spirifer pertenuis Hall. Hamilton (Dev.).

Spirifer pertenuis Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 163.
Spirifera perextensa Hall, Pal. New York, IV, 1867. p. 236.
Loc. Cumberland, Maryland (Whitfield).
Obs. Compare with S. macronota Hall.

Spirifer pharovicinus A. Winchell. Huron (Dev.).

Spirifera pharovicina A. Winchell, Proc. Acad. Nat. Sci. Philadelphia, 1862, p. 406.
Loc. Port aux Barques, Michigan.

Spirifer pinonensis Meek. Lower to Upper Devonian.

Spirifer (Trigonotreta) pinonensis Meek, Proc. Acad. Nat. Sci. Philadelphia, 1870, p. 60;—King's U. S. Geol. Expl. 40th Parl., IV, 1877, p. 45, pl. 1, fig. 9.
Spirifer (Trigonotreta) argentarius Meek, King's U. S. Geol. Expl. 40th Parl., IV, 1877, p. 42, pl. 4, fig. 4.
Spirifera pinonensis Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 138, pl. 4, fig. 1.
Loc. White Pine and Eureka districts, Nevada.

Spirifer planoconvexus Shumard=Ambocœlia planiconvexa.

Spirifer plenus Hall=Syringothyris plena.

Spirifer plicatella of authors=Spirifer radiatus.

Spirifer pluto Clarke. Genesee (Dev.).

Spirifera pluto Clarke, Bull U. S. Geol. Survey, 16, 1885, p. 31, pl. 3, fig. 12.
Loc. Ontario County, New York.
Obs. See Leiorhynchus hecate Clarke.

Spirifer præmatura Hall=Reticularia præmatura.

Spirifer propinquus Hall=Syringothyris texta.

Spirifer prorus Conrad=Spirifer acuminatus.

Spirifer pseudolineatus Hall=Reticularia pseudolineata.

Spirifer pulchrus Meek=Spiriferina pulchra.

Spirifer pyramidalis Hall=Cyrtina pyramidalis.

Spirifer pyxidatus Hall=Metaplasia pyxidata.

Spirifer quichuus d'Orbigny. Devonian.

Spirifer quichua d'Orbigny, Voyage dans l'Amérique Méridionale, Pal., 1842, p. 37, pl. 2, fig. 21.
Loc. Chuquisaca, Bolivia.

Spirifer racinensis McChesney=Spirifer nobilis.

Spirifer radiatus Sowerby. Clinton and Niagara (Sil.).

Spirifer plicatella var. radiata Sowerby, Mineral Conchology, V, 1825, p. 493, figs. 1, 2.
Delthyris bialveata Conrad, Jour. Acad. Nat. Sci. Philadelphia, VIII, 1842, p. 261, pl. 14, fig. 17.
Delthyris radiata Hall, Geol. N. Y.; Rep. Fourth Dist., 1843, p. 105, fig. 2.
Spirifer radiata Hall, Pal. New York, II, 1852, pp. 66, 265, pl. 22, figs. 2d–25 (non 2a–2c=Cyrtia meta); pl. 54, fig. 6.
Spirifera radiata Billings, Canadian Nat. Geol., I, 1856, p. 135, pl. 2, figs. 2, 3;—Geol. Canada, 1863, p. 317, fig. 328.—Hall and Whitfield, Twenty-seventh Rep. N. Y. State Cab. Nat. Hist., 1875, pl. 9, figs. 17, 18.—Hall, Twenty-eighth Rep. Ibidem, 1879, p. 157, pl. 24, figs. 20–30.—White, Second Ann. Rep. Indiana Bureau of Statistics and Geol., 1880, p. 497, pl. 3, figs. 5, 6;—Tenth Rep. State Geol. Indiana, 1881, p. 129, pl. 3, figs. 5, 6.—Hall, Eleventh

Spirifer radiatus Sowerby—Continued.

Rep. Ibidem, 1882, p. 296, pl. 24, figs. 20–30.—Whitfield, Geol. Wisconsin, IV, 1882, p. 287, pl. 17, figs. 1, 2.—Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 51, figs. 9–13, 26 (?14–17).—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 130, pl. 29, figs. 13–16.—Foerste, Proc. Boston Soc. Nat. Hist., XXIV, 1890, p. 313, pl. 5, fig. 6.

Spirifer radiatus Beecher and Clarke, Mem. N. Y. State Mus., I, 1889, p. 77, pl. 6, figs. 9–11.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pp. 13, 35, pl. 21, figs. 5, 9–13, 26 (?14–18).

Spirifer tenuistriatus Shaler (non Hall), Bull. Mus. Com. Zool., 4, 1865, p. 70.

Spirifera plicatella Billings, Catalogue Silurian Fossils of Anticosti, 1866, p. 48.

Spirifera plicatella var. radiata Hall, Twentieth Rep. N. Y. State Cab. Nat. Hist., 1867, p. 371, pl. 13, figs. 9–11.

Loc. Europe; Lockport, Rochester, etc., New York; Hamilton, Ontario; Squatook Lake, New Brunswick; Waldron and Osgood, Indiana; Louisville, Kentucky; Cumberland Gap, Tennessee; Bridgeport, Illinois; Racine, Wauwatosa, and Milwaukee, Wisconsin.

Spirifer raricostus Hall=Delthyris raricosta.

Spirifer rectiplicatus (Conrad). ?Oriskany (Dev.).

Atrypa rectiplicata Conrad, Jour. Acad. Nat. Sci. Philadelphia, VIII, 1842, p. 265.

Loc. "Helderberg Mountains in Middle Silurian limestone."

Obs. May be the same as Metaplasia pyxidata Hall.

Spirifer richardsoni Meek=Reticularia fimbriata.

Spirifer rockymontanus Marcou. Upper Carboniferous.

Spirifer rockymontani Marcou, Geol. North America, March, 1858, p. 50, pl. 7, fig. 4.

Spirifer opima Hall, Geol. Survey Iowa, I, Pt. II, December, 1858, p. 711.

Spirifera subventricosa McChesney, New Pal. Fossils, 1860, p. 44;—Trans. Chicago Acad. Sci., I, 1868, p. 35, pl. 1, fig. 4.

Spirifera opima Derby, Bull. Cornell University, I, 1874, p. 15, pl. 1, fig. 4; pl. 2, fig. 7; pl. 4, fig. 12.—Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 56, figs. 4–7.—Herrick, Bull. Denison Univ., II, 1887, p. 44, pl. 2, fig. 23.

Spirifera (Trigonotreta) opima Meek, Pal. Ohio, II, 1875, p. 329, pl. 19, figs. 14a–14d (?14e);—King's U. S. Geol. Expl. 40th Parl., IV, 1877, p. 88, pl. 9, fig. 6.

Spirifera rockymontana White, Wheeler's Expl. and Survey west 100th Merid., IV, 1875, p. 134, pl. 11, fig. 9.—Keyes, Proc. Acad. Nat. Sci. Philadelphia, 1888, p. 231;—Geol. Survey Missouri, V, 1895, p. 84.

?Spirifera rockymontana? Whitfield, Annals N. Y. Acad. Sci., V, 1891, p. 584, pl. 13, fig. 20;—Geol. Ohio, VII, 1895, p. 471, pl. 9, fig. 20.

Spirifer opimus Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pp. 27, 39, pl. 31, figs. 4–7.

Loc. Tigeras and Canyon of San Antonio, New Mexico; Oquirrh Range, Utah; Arkansas; Iowa; Missouri; Illinois; Indiana; Ohio; Maryland; West Virginia; Bomjardim and Itaituba, Brazil; ?Chester group at Newtonville, Ohio (Whitfield).

Obs. See S. boonensis.

Spirifer rostellatus Hall. Keokuk (L. Carb.).

Spirifer rostellata Hall, Geol. Survey Iowa, I, Pt. II, 1858, p. 641, pl. 20, fig. 2.

Spirifer rostellatus Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 26, pl. 32, fig. 5.

Loc. Skunk River, Iowa.

Spirifer rostellum Hall and Whitfield. Niagara (Sil.).

Spirifera rostellum Hall and Whitfield, Twenty-fourth Rep. N. Y. State Cab. Nat. Hist., 1872, p. 182;—Hall, Twenty-seventh Rep. Ibidem, 1875, pl. 9, figs. 11-13.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 129, pl. 29, fig. 25; pl. 27, figs. 17-19.

Spirifera (Cyrtia) rostellum Foerste, Proc. Boston Soc. Nat. Hist., XXIV, 1890, p. 313, pl. 5, fig. 5.

Loc. Louisville, Kentucky; Collinsville, Alabama.

Spirifer rostratus Morton. Upper Carboniferous.

Spirifer rostrata Morton, American Jour. Sci. Arts, 1836, p. 152, pl. 14, fig. 34.

Loc. Junior Furnace, Scioto County, Ohio.

Obs. Poorly defined. May be a species of Athyris.

Spirifer rugicostus Hall=Delthyris rugicosta.

Spirifer saffordi Hall. Lower Helderberg (Dev.).

Spirifer saffordi Hall, Pal. New York, III, 1859, p. 203, pl. 28, fig. 2.

Loc. Decatur County, Tennessee; Hudson, New York.

Spirifer scobina Meek. Carboniferous.

Spirifera scobina Meek, Proc. Acad. Nat. Sci. Philadelphia, 1860, p. 310.

Spirifer (Spiriferina?) scobina Meek, Simpson's Rep. Expl. Great Basin Terr. Utah, 1876, p. 351, pl. 2, fig. 5.

Spirifera (Trigonotreta) scobina Meek, King's U. S. Geol. Expl. 40th Parl., IV, 1877, p. 90, pl. 9, fig. 1.

Loc. Divide between Long and Ruby Valleys, Utah.

Spirifer sculptilis Hall=Delthyris sculptilis.

Spirifer segmentum Hall. Upper Helderberg (Dev.).

Spirifer segmentus Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 131.

Spirifera segmenta Hall, Pal. New York, IV, 1867, p. 207, pl. 31, figs. 14-19.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 132, pl. 13, figs. 36-38.

Loc. Falls of Ohio; Columbus, Ohio.

Spirifer semiplicatus Hall=Reticularia cooperensis.

Spirifer setigerus Hall=Reticularia setigera.

Spirifer sheppardi Castelnau=Platystrophia biforata.

Spirifer sillanus A. Winchell. Waverly (L. Carb.).

Spirifera sillana A. Winchell, Proc. Acad. Nat. Sci. Philadelphia, 1865, p. 119.

Loc. Near Cuyahoga Falls, Ohio.

Spirifer similior Winchell and Marcy. Niagara (Sil.).

Spirifera (Martinia) similior W. and M., Mem. Boston Soc. Nat. Hist., I, 1865, p. 93.

Pentamerus similior Hall, Twentieth Rep. N. Y. State Cab. Nat. Hist., 1868, p. 397.

Loc. Bridgeport, Illinois.

Obs. This shell has spirals.

Spirifer solidirostris White=Spiriferina solidirostris.

Spirifer sowerbyi Castelnau (non Fischer)=Spirifer pennatus.

Spirifer spinosus Norwood and Pratten=Spiriferina spinosa.

Spirifer striatiformis Meek. Waverly (L. Carb.).

Spirifera (Trigonotreta) striatiformis Meek, Pal. Ohio, II, 1875, p. 280, pl. 14, fig. 8.

Spirifer striatiformis Herrick, Bull. Denison Univ., III, 1888, p. 44, pl. 3, fig. 26; pl. 6, figs. 6, 7;—Geol. Ohio, VII, 1895, pl. 15, fig. 9.

Loc. Sciotoville and Licking County, Ohio.

Spirifer striatus Marcou (non Martin)=Spirifer marcoui.

Spirifer striatus (Martin). Carboniferous.

Anomites striatus Martin, Petrefacta Derbiensia, 1809, pl. 23.

Spirifera striata Davidson, Mon. British Carb. Brach., Pal. Soc., 1857, p. 19, pl. 2, figs. 12–21; pl. 3, figs. 2–6.—White, Wheeler's Expl. and Survey west of 100th Meridian, IV, 1875, pp. 88, 134, pl. 5, fig. 10.—Hall and Whitfield, King's U. S. Geol. Expl. 40th Parl., IV, 1877, p. 269, pl. 5, figs. 13–15.—Hartt, Dawson's Acadian Geology, 3d ed., 1878, p. 301.—Miller, Jour. Cincinnati Soc. Nat. Hist., IV, 1881, p. 2.

Loc. Mountain Spring, Nevada; Oquirrh Mountains, Utah; Lake Valley mining district, New Mexico; Windsor, Nova Scotia.

Spirifer striatus attenuatus Owen=S. keokuk.

Spirifer striatus multicostatus Toula=Spirifer condor.

Spirifer striatus triplicatus Marcou=Spirifer camaratus.

Spirifer strigosus Meek. Devonian.

Spirifera macra Meek (non Hall), Proc. Acad. Nat. Sci. Philadelphia, 1860, p. 309.

Spirifera strigosa Meek, note appended to extras of the paper mentioned above.—Webster, American Nat., XXII, 1888, p. 1102.

Spirifer strigosus Meek, Simpson's Rep. Expl. Great Basin Terr. Utah, 1876, p. 347, pl. 1, fig. 5.

Spirifera (Trigonotreta) strigosa Meek, King's U. S. Geol. Expl. 40th Parl., IV, 1877, p. 43, pl. 3, fig. 5.

Loc. Neils Valley, Utah; Nevada; Rockford, Iowa.

Obs. See S. orestes.

Spirifer subæqualis Hall. Warsaw (L. Carb.).

Spirifer subæqualis Hall, Geol. Survey Iowa, I, Pt. II, 1858, p. 663, pl. 23, fig. 9;—Second Ann. Rep. N. Y. State Geol., 1883, pl. 56, figs. 13, 14.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pp. 26, 36, pl. 31, figs. 13, 14.

Loc. Warsaw, Illinois.

Spirifer subattenuatus Hall. Chemung and Marshall (Dev.-L. Carb.).

Spirifer sp. undet. Owen, Rep. Geol. Survey Wisconsin, Iowa, and Minnesota, 1852, pl. 3, fig. 9.

Spirifera submucronata Hall, Geol. Survey Iowa, I, Pt. II, 1858, p. 504, pl. 4, fig. 3.

Spirifer subattenuata A. Winchell, Proc. Acad. Nat. Sci. Philadelphia, 1862, p. 405.—Whiteaves, Cont. Canadian Pal., I, 1891, p. 223.

Loc. Independence and Buffalo, Iowa; Rock Island, Illinois; Naples, New York; Athabasca River, Canada; in the Marshall group at Port aux Barques, Michigan.

Spirifer subcardiformis Hall. Warsaw (L. Carb.).

Spirifer subcardiformis Hall, Geol. Survey Iowa, I, Pt. II, 1858, p. 660, pl. 23, fig. 6.

Spirifera subcardiformis White, Twelfth Ann. Rep. U. S. Geol. Survey Terr., 1883, p. 165, pl. 41, fig. 2.

Loc. Alton, Illinois; Spergen Hill, Indiana.

Spirifer subcuspidatus Hall=Syringothyris texta.

Spirifer subdecussatus Whiteaves. Hamilton (Dev.).

Spirifera subdecussata Whiteaves, Cont. Canadian Pal., I, 1889, p. 114, pl. 15, fig. 3.

Loc Moravianton Thames River, Canada.

Spirifer subelliptica McChesney=Spiriferina subelliptica.

Spirifer sublineata Meek=Martinia sublineata.

Spirifer submucronatu Hall, 1858 (non 1857)=Spirifer subattenuatus.

Spirifer submucronatus Hall. Oriskany (Dev.).

Spirifer submucronata Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 62;—Pal. New York, III, 1859, p. 419, pl. 96, fig. 7.

Spirifera submucronata Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 58, figs. 5–7.

Spirifer submucronatus Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pp. 17, 36, pl. 33, figs. 5–7.

Loc. Cumberland, Maryland.

Obs. Possibly the young of Spirifer cumberlandia.

Spirifer suborbicularis Hall. Keokuk (L. Carb.).

Spirifer suborbicularis Hall, Geol. Survey Iowa, I, Pt. II, 1858, p. 644.

Spirifera suborbicularis Meek and Worthen, Geol. Survey Illinois, VI, 1875, p. 523, pl. 30, fig. 1.

Loc. Keokuk, Iowa; Warsaw and Nauvoo, Illinois.

Spirifer subrotundatus Hall. Kinderhook (L. Carb.).

Spirifer subrotundata Hall (non McCoy, 1855), Geol. Survey Iowa, I, Pt. II, 1858, p. 521, pl. 7, fig. 8.

Spirifera subrotundata Keyes, Geol. Survey Missouri, V, 1895, p. 78.

Loc. Burlington, Iowa; Sciotoville, Ohio (Winchell).

Obs. This specific name was first used by McCoy in 1855 but is usually regarded as a synonym for S. pinguis Sowerby. De Koninck, however, retains McCoy's name as late as 1887.

Spirifer substrigosus Webster. Chemung (Dev.).

Spirifera substrigosa Webster, American Nat., XXII, 1888, p. 1101.

Loc. Near Rockford, Iowa.

Spirifer subsulcatus Hall. Arisaig (Sil.).

Spirifer subsulcata Hall (non Dalman, 1828), Canadian Nat. Geol., V, 1860, p. 145.

Spirifera subsulcata Dawson, Acadian Geology, 3d ed., 1878, p. 597.—Miller, N. American Geol. and Pal., 1889, p. 376.

Loc. Arisaig, Nova Scotia.

Spirifer subumbona Hall=Martinia subumbona.

Spirifer subundifera Meek and Worthen=Reticularia subundifera.

Spirifer subvaricosus Hall and Whitfield. ?Hamilton (Dev.).

Spirifera subvaricosa Hall and Whitfield, Twenty-third Rep. N. Y. State Cab. Nat. Hist., 1872, p. 237, pl. 11, figs. 12-15.

Loc. Waterloo, Iowa.

Spirifer subventricosus McChesney=Spirifer rockymontana.

Spirifer sulcatus Hall=Delthyris sulcata.

Spirifer sulcifer Shumard. Upper Carboniferous.

Spirifer sulcifera Shumard, Trans. St. Louis Acad. Sci., I, 1858, p. 293, pl. 11, fig. 3.

Loc. Guadalupe Mountains, New Mexico.

Spirifer superbus Billings (non Eichwald)=Spirifer billingsana.

Spirifer taneyensis Swallow. Chouteau (L. Carb.).

Spirifer taneyensis Swallow, Trans. St. Louis Acad. Sci., I, 1860, p. 645.

Spirifera taneyensis Keyes, Geol. Survey Missouri, V, 1895, p. 78.

Loc. Taney County, Missouri.

Spirifer temeraria Miller=Reticularia temeraria.

Spirifer tenuicostatus Hall. Keokuk and Warsaw (L. Carb.).

Spirifer tenuicostata Hall, Geol. Survey Iowa, I, Pt. II, 1858, p. 662, pl. 23, fig. 8.
Loc. Keokuk, Iowa; Warsaw and Dallas, Illinois.

Spirifer tenuimarginatus Hall. Keokuk (L. Carb.).

Spirifer tenuimarginata Hall, Geol. Survey Iowa, I, Pt. II, 1858, p. 641, pl. 20, fig. 1.
Spirifera tenuimarginata Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 57, figs. 4–6.
Spirifer tenuimarginatus Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 38, pl. 32, figs. 4, 6.
Loc. Warsaw, Illinois.

Spirifer tenuis Hall. Hamilton (Dev.).

Spirifer tenuis Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 162.
Spirifera tenuis Hall, Pal. New York, IV, 1867, p. 236.
Loc. Cumberland, Maryland.
Obs. Compare with Spirifer granulosus Conrad.

Spirifer tenuispinatus Herrick=Reticularia tenuispinata.

Spirifer tenuistriatus Shaler (non Hall)=Spirifer radiatus.

Spirifer tenuistriatus Hall. Lower Helderberg (Dev.).

Spirifer tenuistriata Hall, Pal. New York, III, 1859, p. 204, pl. 28, fig. 3.
Spirifera tenuistriata Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 61, fig. 8.
Spirifer tenuistriatus Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 36, fig. 8.
Loc. Decatur County, Tennessee.

Spirifer texasanus Meek. Upper Carboniferous.

Spirifer (Trigonotreta?) texana Meek, Proc. Acad. Nat. Sci. Philadelphia, 1871, p. 179.
Spirifer (Trigonotreta?) texanus Meek, Macomb's Rep. Expl. Exped. from Santa Fe to the Great Colorado of the West, 1876, p. 139, pl. 3, fig. 5.
Spirifera multigranosa Worthen, Geol. Survey Illinois, VIII, 1890, p. 105, pl. 11, fig. 5.
Spirifer texanus Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pp. 26, 38, pl. 37, figs. 16, 17.
Loc. Young and Jack counties, Texas; Springfield, Illinois.

Spirifer textus Hall=Syringothyris texta.

Spirifer translatus Swallow=Reticularia translata.

Spirifer transversus McChesney=Spiriferina transversa.

Spirifer tribulis Hall. Oriskany (Dev.).

Spirifer tribulis Hall, Pal. New York, III, 1859, p. 420, pl. 96, fig. 8;—Second Ann. Rep. N. Y. State Geol., 1883, pl. 58, figs. 1–4.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pp. 19, 37, pl. 33, figs. 1–4.
Loc. Cumberland, Maryland.
Obs. Possibly the young of Spirifer murchisoni.

Spirifer trigonalis (Martin). Carboniferous.

Anomites trigonalis Martin, Petrefacta Derbiensia, tab. 36, 1809, fig. 1.
Spirifera trigonalis Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 215, pl. 18, fig. 11.
Loc. Europe; Eureka district, Nevada.

Spirifer triplicatus Hall=Spirifer camaratus.

Spirifer triradialis Meek (non Phillips)=Spirifer agelaius.

Spirifer troosti Castelnau. **?Formation.**

Spirifer troosti Castelnau, Essai Système Silurien l'Amérique Septentrionale, 1843, p. 41, pl. 12, fig. 5.

Loc. "Kentucky."

Spirifer tullius Hall. Hamilton (Dev.).

Spirifera tullia Hall, Pal. New York, IV, 1867, p. 218, pl. 35, figs. 1-9;—Second Ann. Rep. N. Y. State Geol., 1883, pl. 52, fig. 18.

Spirifera tullia var. Whiteaves, Cont. Canadian Pal., I, 1891, p. 224, pl. 32, fig. 1.

Spirifer tullius Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pp. 14, 35, pl. 22, fig. 18; pl. 37, figs. 6, 7.

Loc. Tully, Apulia, etc., New York; Athabasca River, Canada.

Spirifer tumidus Bayle and Coquand=Spiriferina rostrata.

Spirifer undiferus Roemer=Reticularia undifera.

Spirifer unica Hall=Spirifer arenosus.

Spirifer urbanus Calvin. Hamilton (Dev.).

Spirifera urbana Calvin, Bull. Lab. Univ. of Iowa, 1888, p. 28.—Bull. Lab. Nat. Hist. State Univ. Iowa, II, 1892, p. 166, pl. 12, fig. 1.

Loc. Iowa City and Linn County, Iowa.

Spirifer utahensis Meek=Cyrtia norwoodi.

Spirifer valenteana Rathbun. Middle Devonian.

Spirifera valenteana (Hartt MS.) Rathbun, Bull. Buffalo Soc. Nat. Sci., I, 1874, p. 241, pl. 8, fig. 11.

Loc. Erere, Province of Para, Brazil.

Spirifer vanuxemi Hall. Tentaculite (Sil.).

Orthis plicata Vanuxem (non Sowerby), Geol. New York; Rep. Third Dist., 1842, p. 112, fig. 1.

Orthis? (Delthyris) plicatus Hall, Ibidem, Fourth Dist., 1843, p. 142, fig. 1.

Spirifer vanuxemi Hall, Pal. New York, III, 1859, p. 198, pl. 8, figs. 17-23;—Second Rep. N. Y. State Geol., 1883, pl. 61, fig. 11.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pp. 19, 36, pl. 36, fig. 11.—Whitfield, Geol. Ohio, VII, 1895, p. 411, pl. 1, figs. 4, 5.

Spirifera vanuxemi Whitfield, Annals N. Y. Acad. Sci., V, 1891, p. 509, pl. 5, figs. 4, 5.

Loc. Albany and Schoharie counties, New York; Put in Bay Island, Lake Erie.

Obs. Vanuxem's specific name is restored, since Sowerby's species is an Orthis.

Spirifer varicosus Hall. Corniferous (Dev.).

Spirifer varicosa Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 130.

Spirifera varicosa Billings, Canadian Jour., VI, 1861, p. 255, figs. 63, 64;—Geol. Canada, 1863, p. 960, fig. 467.—Hall, Pal. New York, IV, 1867, p. 205, pl. 31, figs. 1-4;—Second Rep. N. Y. State Geol., 1883, pl. 59, figs. 4-8.—Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 136.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 134, pl. 10, figs. 11-20, 23-25.

Spirifer varicosus Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pp. 17, 36, pl. 34, figs. 4-8.

Loc. Williamsville, New York; Woodstock, Canada; Columbus, Ohio; Louisville, Kentucky; Eureka district, Nevada.

Spirifer ventricosa Hall=Nucleospira ventricosa.

Spirifer venustus Hall=Spirifer divaricatus.

Spirifer vernonensis Swallow. Chouteau (L. Carb.).

Spirifer vernonensis Swallow, Trans. St. Louis Acad. Sci., I, 1860, p. 644.—A. Winchell, Proc. Acad. Nat. Sci. Philadelphia, 1865, p. 119.

Loc. St. Louis County, Missouri.

Obs. Regarded by Keyes as a synonym for S. marionensis.

Spirifer vernonensis ozarkensis Swallow. Chouteau (L. Carb.).

Spirifer vernonensis var. ozarkensis Swallow, Trans. St. Louis Acad. Sci., I, 1860, p. 644.

Loc. Taney County, Missouri.

Obs. Regarded by Keyes as a synonym for S. marionensis.

Spirifer vogeli von Ammon. Middle Devonian.

Spirifer vogeli von Ammon, Zeits. Gesell. für Erdk., Berlin, XXVIII, 1893, p. 362, fig. 6.

Loc. Taquarassu, Mato Grosso, Brazil.

Spirifer waldronensis Miller and Dyer=Mimulus waldronensis.

Spirifer waverlyensis A. Winchell. Waverly (L. Carb.).

Spirifer waverlyensis A. Winchell, Proc. Amer. Phil. Soc., XII, 1870, p. 251.

Loc. "Newark, Ohio" (A. Winchell's MS.).

Spirifer whitneyi Hall. Chemung (Dev.).

Spirifer whitneyi Hall, Geol. Survey Iowa, I, Pt. II, 1858, p. 502, pl. 4, fig. 2.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pp. 24, 57, pl. 30, figs. 18, 19.

Spirifera whitneyi Hall, Pal. New York, IV, 1867, pp. 243, 417;—Second Rep. N. Y. State Geol., 1883, pl. 55, figs. 18, 19.—Tschernyschew, Mém. du Comité Géol. de St. Petersbourg, III, 1887, p. 60.

Loc. Rockford, Iowa; North Saskatchewan, Canada; Russia.

Spirifer williamsi Hall and Clarke. Chemung (Dev.).

Spirifer williamsi Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, p. 361, pl. 37, figs. 20–22.

Loc. Allegany County, New York.

Spirifer winchelli Herrick. Waverly (L. Carb.).

Spirifer winchelli Herrick, Bull. Denison Univ., III, 1888, p. 46, pl. 5, figs. 2, 3; pl. 2, fig. 16;—Geol. Ohio, VII, 1895, pl. 21, figs. 2, 3.

Loc. Granville, Ohio.

Spirifer worthenanus Schuchert. Oriskany (Dev.).

Spirifera engelmanni Meek and Worthen (non Meek, 1860), Geol. Survey Illinois, III, 1868, p. 398, pl. 8, fig. 5.

Spirifera wortheni Meek (non Hall, 1857), King's U. S. Geol. Expl. 40th Parl., IV, 1877, p. 42.

Spirifera worthenana Schuchert, Ninth Ann. Rep. N. Y. State Geol., 1890, p. 54.

Loc. Union County, Illinois.

Spirifer wortheni Meek (non Hall)=Spirifer worthenanus.

Spirifer wortheni Hall. Hamilton (Dev.).

Spirifer wortheni Hall, Tenth Rep., N. Y. State Cab. Nat. Hist., 1857, p. 156.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 27, figs. 19, 20.

Loc. Calhoun County, Illinois.

Spirifer ziczac Hall (non Roemer)=Delthyris consobrina.

SPIRIFERINA d'Orbigny.

Genotype Spirifer walcotti Sowerby=S. rostrata (Schlotheim).

Spiriferina d'Orbigny, Paris Acad. Sci., Comptes Rendus, XXV, 1847, p. 268;—Ann. Sci. Nat., XIII, 1850, p. 334.—White, Proc. Boston Soc. Nat. Hist., IX, 1862, p. 24.—Waagen, Palæontologica Indica, Ser. XIII, I, 1883, p. 498.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 51;—Thirteenth Ann. Rep. N. Y. State Geologist, 1895, p. 764.

Spiriferina aciculifera (Rowley). Kinderhook (L. Carb.).

Spirifera aciculifera Rowley, American Geologist, XII, 1893, p. 307;—Ibidem, 1893, pl. 14, figs. 13, 14.

Loc. Louisiana, Missouri.

Spiriferina (?) alia Hall and Whitfield. Triassic.

Spirifera (Spiriferina?) alia Hall and Whitfield, King's U. S. Geol. Expl. 40th Parl., IV, 1877, p. 281, pl. 6, fig. 17.

Loc. Dun Glen Pass, Pah-Ute Range, Nevada.

Spiriferina billingsi Shumard. Upper Carboniferous.

Spiriferina billingsi Shumard, Trans. St. Louis Acad. Sci., I, 1858, p. 294, 391.

Loc. Guadalupe Mountains, New Mexico and Texas.

Spiriferina binacuta A. Winchell. Burlington (L. Carb.).

Spiriferina binacuta A. Winchell, Proc. Acad. Nat. Sci. Philadelphia, 1865, p. 120.

Loc. Burlington, Iowa.

Spiriferina borealis Whiteaves. Triassic.

Spiriferina borealis Whiteaves, Cont. Canadian Pal., I, 1888, p. 128, pl. 17, fig. 1, abstract.

Loc. Liard River, Canada.

Spiriferina clarksvillensis A. Winchell. Chouteau (L. Carb.).

Spiriferina clarksvillensis A. Winchell, Proc. Acad. Nat. Sci. Philadelphia, 1865, p. 119.—Keyes, Geol. Survey Missouri, V, 1895, p. 85.

Loc. Clarksville, Missouri.

Spiriferina cristata Walcott=S. spinosa.

Spiriferina cristata (Schlotheim). Upper Carboniferous.

Terebratulites cristatus Schlotheim, Beit. zur Naturg. der Verst.; Akad. der Wiss. zu München, 1816, pl. 1, fig. 3.

Spirifer octoplicata? Hall (non Sowerby), Stansbury's Exped. Great Salt Lake of Utah, 1852, p. 409, pl. 4, fig. 4.

Spirifer kentuckyensis Shumard, Geol. Survey Missouri, I, 1855, p. 203.—Hall, Pacific Railroad Rep., III, 1856, p. 102, pl. 2, figs. 10, 11.—Meek and Hayden, Proc. Acad. Nat. Sci. Philadelphia, 1859, p. 27.

Spiriferina cristata Davidson, Quart. Jour. Geol. Soc. London, 1863, p. 170, pl. 9, fig. 6.—Dawson, Acadian Geol., 3d ed., 1878, p. 291, fig. 90.—Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 218, pl. 18, figs. 12, 13.—Smith, Proc. American Phil. Soc., XXV, 1897, p. 32.

Spirifer laminosus Geinitz (non McCoy), Carb. und Dyas in Nebraska, 1866, p. 45, pl. 3, fig. 19.

Spirifer kentuckyensis var. propatulus Swallow, Trans. St. Louis Acad. Sci., II, 1866, p. 489.

?Spiriferina octoplicata Toula, Sitzungsb. der kais. Akad. der Wissensch. zu Wien, LIX, 1869, p. 5.

Spiriferina kentuckyensis Meek, Final Rep. U. S. Geol. Survey of Nebraska, 1872, p. 185, pl. 6, fig. 3; pl. 8, fig. 11.—White, Wheeler's Expl. and Survey west 100th Meridian, IV, 1875, p. 138, pl. 10, fig. 4;—Thirteenth Rep. Indiana State Geol., 1884, p. 135, pl. 35, figs. 13, 14.—Keyes, Proc. Acad. Nat. Sci. Philadelphia, 1890, p. 231.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 52, fig. 41, pl. 29, fig. 17.—Keyes, Geol. Survey Missouri, V, 1895, p. 86.

Spiriferina cristata? Etheridge, Quart. Jour. Geol. Soc. London, XXXIV, 1878, p. 629.

Spirifer (Spiriferina) kentuckyensis Hall, Second Rep. N. Y. State Geol., 1883, pl. 61, figs. 14–16.

Spiriferina cristata (Schlotheim)—Continued.

Loc. Europe; Kentucky; Indiana; Illinois; Missouri; Iowa; Kansas; Arkansas; Nebraska; Texas; New Mexico; Utah; Arizona; Nevada; Nova Scotia; Cape Joseph Henry, lat. 82° 43′; near Cochabamba, Bolivia.

Obs. See Spiriferina octoplicata and S. norwoodana.

Spiriferina depressa Herrick. Waverly (L. Carb.).

Spiriferina depressa Herrick, Bull. Denison Univ., III, 1888, p. 47, pl. 10, fig. 3.

Loc. Near Granville, Ohio.

Spiriferina gonionotus Meek. Upper Carboniferous.

Spiriferina sp. undet. Meek, King's U. S. Geol. Expl. 40th Parl., IV, 1877, p. 84, pl. 8, fig. 5.

Spiriferina gonionota Meek, Ibidem, 1877, at end of description.

Loc. Diamond Mountains, Nevada.

Obs. Compare with Spiriferina laminosa (McCoy).

Spiriferina homfrayi (Gabb). Triassic.

Spirifer ? homfrayi Gabb, Geol. Survey California, Pal., I, 1864, p. 35, pl. 6, fig. 38.

Spiriferina homfrayi Hall and Whitfield, King's U. S. Geol. Expl. 40th Parl., IV, 1877, p. 281, pl. 6, fig. 18.

Loc. Star Canyon, Humboldt County, Nevada; Dun Glen Pass, Pah-Ute Range, Nevada.

Spiriferina kentuckyensis Shumard=Spiriferina cristata.

Spiriferina kentuckyensis propatula Swallow=Spiriferina cristata.

Spiriferina cfr. munsteri Davidson. Jurassic.

Spiriferina cf. munsteri (Dav.) Möricke, Neues Jahrbuch f. Mineral., Beilageband, IX, 1894, p. 60.

Loc. Europe; Cordillere of Copiapo, Chile.

Spiriferina norwoodana (Hall). Warsaw (L. Carb.).

Spirifer norwoodana Hall, Trans. Albany Inst., IV, 1858, p. 7.

Spiriferina norwoodana Whitfield, American Mus. Nat. Hist., I, 1882, p. 48, pl. 6, figs. 16, 17.—Hall, Twelfth Rep. State Geol. Indiana, 1883, p. 327, pl. 29, figs. 16, 17.

Loc. Spergen Hill, Indiana; Alton, Illinois; Princeton, Kentucky.

Obs. Probably identical with Spiriferina cristata.

Spiriferina obtusa (Gabb). Triassic.

Spirifer obtusus Gabb, American Jour. Conch., V, 1870, p. 17, pl. 7, fig. 16.

Loc. "Volcano," Nevada.

Spiriferina octoplicata (Sowerby). Upper Carboniferous.

Spirifer octoplicata Sowerby, Mineral Conch., 1827, p. 120, pl. 562, figs. 2–4.

Spiriferina cristata var. octoplicata Davidson, Mon. British Carb. Brach., Pal. Soc., 1857, p. 38, pl. 7, figs. 37–47.

Spiriferina spinosa var. campestris White, Wheeler's Expl. and Survey west 100th Merid., Prel. Rep., 1874, p. 21.

Spiriferina octoplicata White, Ibidem, Final Rep., 1875, p. 139, pl. 10, fig. 8.

Loc. Europe; Santa Fe, New Mexico; northern Colorado; Lincoln County, Nevada.

Obs. Probably identical with Spiriferina cristata.

Spiriferina pulchra Meek. Upper Carboniferous.

Spirifera pulchra Meek, Proc. Acad. Nat. Sci. Philadelphia, 1860, p. 310.

Spiriferina pulchra Meek, Pal. Upper Missouri, Smithsonian Cont. to Knowl., XIV, 1864, 172, p. 19;—King's U. S. Geol. Expl. 40th Parl., IV, 1877, p. 85, pl. 8, fig. 1; pl. 12, fig. 12.

Spiriferina pulchra Meek—Continued.

Spirifer (Spiriferina) pulcher, Meek. Simpson's Rep. Expl. Great Basin Terr. Utah, 1876, p. 352, pl. 2, fig. 1.

Loc. White Pine district, Nevada; Long and Ruby valleys, Utah.

Spiriferina rostrata Schlotheim. Jurassic.

Spirifer chilensis Forbes, Darwin's Geol. Observations S. America, 1846, p. 267, pl. 5, figs. 15, 16.

Spirifer linguiferoides Forbes, Ibidem, 1846, p. 267, pl. 5, figs. 17, 18.

Spirifer tumidus Bayle and Coquand, Mém. Géol. Soc. France, ser. ii, IV, 1851, p. 19, pl. 7, figs. 11, 12.

Spirifer chilensis and rostratus Burmeister and Geibel, Abh. Naturf. Gesell. Halle, VI, 1862, p. 125.

Spiriferina rostrata (Schl.) Möricke, Neues Jahrb. f. Mineral., Beilageband, IX, 1894, p. 59.

Loc. Europe; Sierra de la Ternera, Las Amolanes, Rio Claro, Tres Cruces, Manfias, Cordillera de Guasco, and Juntas, Chile.

Spiriferina solidirostris White. Kinderhook (L. Carb.).

Spirifer solidirostris White, Jour. Boston Soc. Nat. Hist., VII, 1860, p. 232.

Spiriferina solidirostris White, Ibidem, IX, 1862, p. 24.—A. Winchell, Proc. Acad. Nat. Sci. Philadelphia, 1865, p. 120.—Herrick, Bull. Denison Univ., III, 1888, p. 47, pl. 2, figs. 9–11; pl. 5, fig. 13;—Geol. Ohio, VII, 1895, pl. 21, fig. 13.

Loc. Burlington, Iowa; Hamburg, Illinois; Newark and Sciotoville, Ohio.

Spiriferina spinosa (Norwood and Pratten). Kaskaskia (L. Carb.).

Spirifer spinosa Norwood and Pratten, Jour. Acad. Nat. Sci. Philadelphia, 2d ser., III, 1856, p. 71, pl. 9, fig. 1.—Hall, Geol. Survey Iowa, I, Pt. II, 1858, p. 706, pl. 27, fig. 5.

Spiriferina spinosa? Derby, Bull. Cornell Univ., I, 1874, p. 23, pl. 6, figs. 8, 13, 14.

Spiriferina spinosa Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 60, figs. 26–29.

Spiriferina cristata Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 218, pl. 18, figs. 12, 13.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pp. 52–54, pl. 35, figs. 26–29.

? Spiriferina spinosa Herrick, Bull. Geol. Soc. America, II, 1891, p. 46, pl. 1, fig. 19.

Loc. Kaskaskia, Alton, and Chester, Illinois; Bloomington, Indiana; Crittenden County, Kentucky; Itaituba, Brazil.

Spiriferina spinosa campestris White=Spiriferina octoplicata.

Spiriferina subelliptica (McChesney). Keokuk (L. Carb.).

Spirifer subelliptica McChesney, New Pal. Fossils, 1860, p. 43.

Spiriferina subelliptica Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 54, pl. 35, figs. 21, 22.

Loc. Buttonmould Knob, Kentucky; New Providence, Indiana.

Spiriferina subtexta White. Burlington (L. Carb.).

Spiriferina ? subtexta White, Proc. Boston Soc. Nat. Hist., IX, 1862, p. 25.

Loc. Burlington, Iowa.

Spiriferina transversa (McChesney). Kaskaskia (L. Carb.).

Spirifer transversa McChesney, New Pal. Fossils, 1860, p. 42;—Trans. Chicago Acad. Sci., I, 1868, p. 34, pl. 6, fig. 3.—Hall, Second Rep. N. Y. State Geol., 1883, pl. 60, figs. 19–22.

Spiriferina transversa (McChesney)—Continued.

Spiriferina transversa Derby, Bull. Cornell Univ., I, 1874, p. 21, pl. 2, figs. 4, 5, 6, 13; pl. 13, figs. 12–14, 17; pl. 5, fig. 4.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pp. 46, 64, pl. 35, figs. 19, 20, 23–25.

Loc. Buzzards Roost, Alabama; Litchfield, Kentucky; Bomjardim and Itaituba, Brazil.

Spirigera d'Orbigny=Athyris.

Spirigera eborea A. Winchell=Athyris fultonensis.

Spirigera planosulcata White (non Phillips)=Cleiothyris crassicardinalis.

SPIRIGERELLA Waagen. Genotype S. derbyi Waagen.

Spirigerella Waagen, Palæontologica Indica, Ser. XIII, I, 1883, p. 450.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 98;—Thirteenth Ann. Rep. N. Y. State Geologist, 1895, p. 782.

Spirigerella derbyi Waagen. Upper Carboniferous.

Athyris subtilita (partim) Derby, Bull. Cornell Univ., I, 1874, p. 7, pl. 1, fig. 7 (not the other figures).

Spirigerella derbyi Waagen, Palæontologica Indica, Ser. XIII, I, 1883, p. 453, pl. 35, figs. 4–7, 9–13; pl. 37, figs. 11–13.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 99, fig. 73.

Loc. Bomjardim and Itaituba, Brazil.

Stenochisma Œhlert (non Conrad or Hall)=Camarophoria.

STENOCHISMA Conrad. Genotype Terebratulites schlotheimii Conrad (non von Buch)=Rhynchonella formosa Hall.

Stenocisma Conrad, Second Ann. Rep. N. Y. Geol. Survey, 1839, pp. 58, 59.—Meek and Hayden (partim), Pal. Upper Missouri, Smithsonian Cont. to Knowl., XIV, 172, 1864, p. 16, footnote.—Hall, Pal. New York, IV, 1867, pp. 334, 335.—Waagen, Palæontologica Indica, Ser. XIII, I, 1883, pp. 411, 431, 436.—Miller, N. American Geol. and Pal., 1890, p. 337.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 187;—Thirteenth Ann. Rep. N. Y. State Geol., 1895, p. 826.

Obs. The above synonymy is retained for historical purposes. The only species left in the genus by Hall and Clarke is the type species, Rhynchonella formosa, which seems to be nothing more than a Rhynchotrema. This will leave Stenochisma without a species. This name, however, should not displace either Rhynchotrema or Camarotœchia, since it was not defined, and in addition to this was founded by Conrad upon an erroneous identification. Nor can the view of Œhlert be adopted, i. e., that Stenochisma should displace Camarophoria King, because Conrad gave as the type C. schlotheimii. This name did not apply to von Buch's species, but to the shell now known as Rhynchonella formosa Hall.

All the species formerly referred to Stenochisma will be found under Camarotœchia except R. formosa, which is referred to Rhynchotrema.

Stenocisma Hall, 1857 (non Conrad, 1839, Hall, 1867)=Zygospira.

STREPTIS Davidson. Genotype Terebratula grayi Davidson.

Streptis Davidson, Geol. Mag., VIII, 1881, p. 150, pl. v, fig. 13.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 274;—Eleventh Ann. Rep. N. Y. State Geologist, 1894, p. 289.

Streptis grayi Davidson. Niagara (Sil.).

Terebratula grayii Davidson, Bull. Soc. Géol. France, 2d ser., V, 1848, p. 331, pl. iii, fig. 33.

Streptis grayi Davidson—Continued.

Atrypa? grayi Davidson, British Sil. Brach., Paleontographical Soc. (1866), 1867, p. 141, pl. xiii, figs. 14–22.

Streptis grayi Williams, American Jour. Sci., 3d ser., XLVIII, 1894, p. 331.

Loc. England; Batesville, Arkansas.

Streptis waldronensis Beecher and Clarke=Mimulus waldronensis.

STREPTORHYNCHUS King.

Genotype Terebratulites pelargonatus Schlotheim.

Streptorhynchus King, Mon. Permian Fossils, Pal. Soc., 1850, p. 107.—Derby (partim), Bull. Cornell Univ., I, 1874, pp. 32, 39.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 267;—Eleventh Ann. Rep. N. Y. State Geologist, 1894, p. 288.

Streptorhynchus æquivalvis Hall=Orthothetes inæqualis.

Streptorhynchus agassizi Rathbun=Orthothetes agassizi.

Streptorhynchus approximata James=Strophomena approximata.

Streptorhynchus arctostriata Walcott=Orthothetes chemungensis arctistriatus.

Streptorhynchus biloba Hall=Derbya biloba.

Streptorhynchus cardinale Whitfield=Strophomena cardinalis.

Streptorhynchus chemungensis Hall=Orthothetes chemungensis.

Streptorhynchus coreanus Derby=Derbya correana.

Streptorhynchus crenistria Keyes (non Phillips)=Derbya crassa.

Streptorhynchus crenistrius American authors=Orthothetes crenistria.

Streptorhynchus elongatus James=Strophomena rugosa.

Streptorhynchus filitextus Hall=Strophomena incurvata.

Streptorhynchus flabellum Whitfield=Orthothetes flabellum.

Streptorhynchus hallianus Derby. Upper Carboniferous.

Streptorhynchus hallianus Derby, Bull. Cornell Univ., I, 1874, p. 35, pl. 5, figs. 1, 2, 5, 8, 12, 14, 16, 18; pl. 8, fig. 3.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 268, pl. 11, figs. 6–17.

Loc. Bomjardim and Itaituba, Brazil.

Streptorhynchus hallanum Miller=Strophomena halli.

Streptorhynchus hemiaster Winchell and Marcy=Orthothetes subplanus.

Streptorhynchus hydraulicum Whitfield=Orthothetes hydraulicus.

Streptorhynchus inæqualis Winchell=Orthothetes inæqualis.

Streptorhynchus inflatus White and Whitfield=Orthothetes inflatus.

Streptorhynchus lens White=Orthothetes lens.

Streptorhynchus minor Walcott=Strophomena minor.

Streptorhynchus (?) multistriata (Meek and Hayden).

Upper Carboniferous.

Orthisina umbraculum? Meek and Hayden, Proc. Acad. Nat. Sci. Philadelphia, 1859, p. 26.

Orthisina multistriata Meek and Hayden, Ibidem, 1859, at end of description.

Loc. Fort Riley, Kansas.

Streptorhynchus neglectus James=Strophomena neglecta.

Streptorhynchus occidentalis Newberry=Meekella occidentalis.

Streptorhynchus pandora Billings=Orthothetes pandora.
Streptorhynchus perversus=Orthothetes chemungensis perversus.
Streptorhynchus planoconvexus Hall=Strophomena planiconvexa.
Streptorhynchus planumbonus Hall=Strophomena rugosa.
Streptorhynchus primordiale Whitfield=Billingsella primordialis.
Streptorhynchus pyramidalis Newberry=Meekella pyramidalis.
Streptorhynchus robusta Hall=Derbya robusta.
Streptorhynchus subplanus Hall=Orthothetes subplanus.
Streptorhynchus subsulcatum Sardeson=Strophomena scofieldi.
Streptorhynchus subtenta Hall, 1883=Strophomena trentonensis.
Streptorhynchus tapajotensis Derby=Orthothetes tapajotensis.
Streptorhynchus tenuis Hall=Orthothetes tenuis.

Streptorhynchus ulrichi Hall and Clarke. Kaskaskia (L. Carb.).
Streptorhynchus ulrichi Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 268, 351, pl. 11B, fig. 15.
Loc. Crittenden County, Kentucky.

Streptorhynchus umbraculum Winchell=Orthothetes umbraculum.
Streptorhynchus vetusta James=Strophomena vetusta.
Streptorhynchus woolworthianus Hall=Orthothetes woolworthianus.
Stricklandia Billings=Stricklandinia.
Stricklandia arachne Billings=Syntrophia arachne.
Stricklandia arethusa Billings=Syntrophia arethusa.

STRICKLANDINIA Billings. Genotype Stricklandia gaspensis Bill.
Stricklandia Billings, Canadian Nat. and Geol., IV, 1859, p. 132;—Canadian Journal, VI, 1861, p. 265;—Pal. Fossils, I, 1862, p. 84;—Proc. Portland Soc. Nat. Hist., 1863, p. 114.—Waagen, Palæontologica Indica, Ser. XIII, I, 1883, p. 412.
Stricklandinia Billings, Canadian Nat. and Geol., VIII, 1863, p. 370.—Hall, Twentieth Rep. N. Y. State Cab. Nat. Hist., 1867, p. 160;—Pal. New York, IV, 1867, p. 369.—Billings, Pal. Fossils, II, 1874, p. 78.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 64.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 249;—Thirteenth Ann. Rep. N. Y. State Geologist, 1895, p. 847.

Stricklandinia anticostiensis Billings. Anticosti (Sil.).
Stricklandinia anticostiensis Billings, Canadian Nat. and Geol., VIII, 1863, p. 370.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 251, pl. 73, figs. 12–14.
Loc. Anticosti.

Stricklandinia billingsana Dawson. Arisaig (Sil.).
Stricklandinia billingsiana Dawson, Canadian Nat. and Geol., 2d ser., IX, 1880, p. 341.
Loc. Nova Scotia.

Stricklandinia brevis Billings. Anticosti (Sil.).
?Spirifer species? Hall, Pal. New York, II, 1852, p. 66, pl. 22, fig. 3.
Stricklandia brevis Billings, Canadian Nat. and Geol., IV, 1859, p. 135.
Stricklandinia brevis Billings, Pal. Fossils, II, 1874, p. 84, pl. 6, fig. 2.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 251.
Loc. Anticosti; ?Sodus, Wayne County, New York.

Stricklandinia canadaensis Billings. Clinton (Sil.).

Stricklandia canadensis Billings, Canadian Nat. and Geol., IV, 1859, p. 135.

Stricklandinia canadensis Billings, Pal. Fossils, II, 1874, p. 81.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 251.

Loc. Near Thorold, Ontario.

Stricklandinia castellana White. Niagara (Sil.).

Stricklandinia castellana White, Proc. Acad. Nat. Sci. Philadelphia, 1876, p. 30.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 251, pl. 73, figs. 3–7.

Loc. Castle Grove, Jones County, Iowa.

Stricklandinia chapmani Hall and Clarke. Niagara (Sil.).

Stricklandinia chapmani Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 83, fig. 40.

Loc. Hamilton, Ontario.

Stricklandinia davidsoni Billings. Anticosti (Sil.).

Stricklandinia davidsoni Billings, Geol. Mag., V, 1868, p. 59, pl. 4, figs. 1–1*d*;—Pal. Fossils, II, 1874, p. 86, pl. 6, fig. 1.—White, Proc. U. S. Nat. Mus., III, 1880, p. 48.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 251, pl. 73, fig. 15.

Loc. Anticosti; eastern Canada; Ringgold, Catoosa County, Georgia.

Stricklandinia deformis Meek and Worthen. Niagara (Sil.).

Stricklandinia deformis Meek and Worthen, Proc. Acad. Nat. Sci. Philadelphia, 1870, p. 37;—Geol. Survey Illinois, VI, 1875, p. 502, pl. 24, fig. 5.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 251, pl. 73, figs. 8–10.

Loc. Carroll County, Illinois.

Obs. Probably the same as S. melissa.

Stricklandinia elongata Billings=Amphigenia elongata.

Stricklandinia elongata curta Meek and Worthen=Amphigen'a curta.

Stricklandinia gaspiensis Billings. Gaspé (Sil.).

Stricklandia gaspiensis Billings, Canadian Nat. and Geol., IV, 1859, p. 134.

Stricklandinia gaspiensis Billings, Pal. Fossils, II, 1874, p. 83, fig. 49;—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 251, pl. 73, fig. 11.

Loc. Bay of Chaleurs, Canada.

Stricklandinia lens (Sowerby). Silurian.

Atrypa lens Sowerby, Murchison's Silurian System, 1839, pl. 21, fig. 3.

Stricklandinia lens Billings, Catalogue Sil. Foss. Anticosti, 1866, p. 45.—Foerste, Proc. Boston Soc. Nat. Hist., XXIV, 1890, p. 321, pl. 5, figs. 1–4.

Loc. England; Anticosti; Collinsville, Alabama.

Stricklandinia lirata (Sowerby). Anticosti (Sil.).

Spirifer liratus Sowerby, Murchison's Silurian System, 1839, pl. 22. fig. 6.

Stricklandinia lirata Davidson, Mon. British Sil. Brach., Pal. Soc., 1867, p. 159, pl. 20, figs. 1–13.—Billings, Cat. Sil. Foss. Anticosti, 1866, p. 45.

Loc. Europe; Anticosti.

Stricklandinia (?) louisvillensis Nettelroth. Niagara (Sil.).

Stricklandinia louisvillensis Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 65, pl. 34, figs. 31–34.

Loc. East of Louisville, Kentucky.

Stricklandinia melissa Billings. Anticosti (Sil.).

Stricklandinia melissa Billings, Pal. Fossils, II, 1874, p. 89, pl. 7, fig. 4.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 251.

Loc. Anticosti.

Obs. Probably the same as S. deformis.

Stricklandinia multilirata Whitfield. Guelph (Sil.).

Stricklandinia multilirata Whitfield, Ann. Rep. Geol. Survey Wisconsin, 1877, p. 81;—Geol. Wisconsin, IV, 1882, p. 315, pl. 23, figs. 3–5.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 251, pl. 73, figs. 1, 2.

Loc. Sheboygan, Wisconsin.

Stricklandinia salteri Billings. Anticosti (Sil.).

Stricklandinia salteri Billings, Geol. Mag., V, 1868, p. 61, pl. 4, figs. 2–2*a*;—Pal. Fossils, II, 1874, p. 87, pl. 7, fig. 1.—White, Proc. U. S. Nat. Mus., III, 1880, p. 48.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 251.

Loc. Anticosti; Ringgold, Catoosa County, Georgia.

Stricklandinia (?) subquadrata Herrick. Upper Carboniferous.

Stricklandinia ? subquadrata Herrick, Bull. Denison Univ., II, 1887, p. 49, pl. 1, fig. 14.

Loc. Flint ridge, near Newark, Ohio.

Obs. Probably a terebratuloid.

Stricklandinia triplesiana Foerste. Clinton (Sil.).

Stricklandinia triplesiana Foerste, Bull. Denison Univ., I, 1885, p. 89, pl. 14, figs. 13, 14.—Proc. Boston Soc. Nat. Hist., XXIV, 1890, p. 323;—Geol. Ohio, VII, 1895, p. 594, pl. 26, figs. 13, 14.

Loc. Dayton, Ohio.

STRINGOCEPHALUS Defrance. Genotype S. burtini Defrance.

Strygocephalus Defrance, Dict. Sci. Nat., LI, 1827, p. 102, pl. 75, fig. 1.

Stringocephalus Sandberger, Leonhard und Bronn's Jahrb. für Min., 1842, p. 386.—Dall, American Jour. Conch., VI, 1870, p. 112.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 282, figs. 203–207.

Stringocephalus burtoni Defrance. Middle Devonian.

Strygocephalus burtoni Defrance, Dict. Sci. Nat., LI, 1827, p. 102, pl. 75, fig. 1.

Stringocephalus burtoni Whiteaves, Trans. Royal Soc. Canada, VIII, 1891, p. 93;—Cont. to Canadian Pal., I, 1891, p. 235, pl. 29, figs. 10–11; p. 290.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 283, fig. 203.

Loc. Europe; Lakes Manitoba and Winnipegosis and the "Ramparts," Mackenzie River, British America. Two loose specimens have been found near Devonian rocks in southern Minnesota.

STROPHALOSIA King. Genotype Orthis excavata Geinitz.

Strophalosia King, Ann. and Mag. Nat. Hist., XIV, 1844, p. 313;—Ibidem, XVII, 1846, p. 92;—Mon. Permian Fossils, Pal. Soc., 1850, p. 93.—Hall, Twentieth Rep. N. Y. State Cab. Nat. Hist., 1867, p. 245;—Pal. New York, IV, 1867, p. 146.—Beecher, American Jour. Sci., 3d ser., XL, 1890, p. 240.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 314;—Eleventh Ann. Rep. N. Y. State Geologist, 1894, p. 295.

Strophalosia beecheri Rowley. Kinderhook (L. Carb.).

Strophalosia beecheri Rowley, American Geologist, XII, 1893, p. 308, pl. 14, figs. 18, 19.

Loc. Louisiana, Missouri.

Strophalosia cornelliana Derby. Upper Carboniferous.

Strophalosia cornelliana Derby, Bull. Cornell Univ., I, 1874, p. 45, pl. 3, figs. 28, 30, 32, 33, 35–38; pl. 4, fig. 5; pl. 8, fig. 17; pl. 9, figs. 10, 11.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 15B, figs. 36, 37.

Loc. Bomjardim, Brazil.

Strophalosia cymbula Hall and Clarke. Keokuk (L. Carb.).

Strophalosia cymbula Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 17A, figs. 3, 4, 8, 9.

Loc. Near Louisville and Lebanon, Kentucky.

Strophalosia (?) guadalupensis (Shumard). Upper Carboniferous.

Aulosteges guadalupensis Shumard, Trans. St. Louis Acad. Sci., I, 1858, p. 292, pl. 11, fig. 5; p. 390.

Strophalosia ? guadalupensis Beecher, American Jour. Sci., 3d ser., XL, 1890, p. 241.

Loc. Guadalupe Mountains, New Mexico and Texas.

Strophalosia horrescens Geinitz (non Murchison, de Verneuil, and Keyserling)=Productus nebraskaensis.

Strophalosia hystricula Hall. Chemung (Dev.).

Productella hystricula Hall, Pal. New York, IV, 1867, p. 178, pl. 26, figs. 1–8;—Second Ann. Rep. N. Y. State Geol., 1883, pl. 48, figs. 29, 30.

Strophalosia hystricula Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 316, pl. 15B, fig. 31; pl. 17, figs. 29, 30.

Loc. Forestville, Conewango, and East Randolph, New York.

Strophalosia keokuk Beecher. Keokuk (L. Carb.).

Strophalosia keokuk Beecher, American Jour. Sci., 3d ser., XL, 1890, p. 244, pl. 9, figs. 18–24.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 316, pl. 17A, figs. 5–7.

Loc. Keokuk, Iowa.

Strophalosia muricata (Hall). Chemung (Dev.)

Chonetes muricata Hall, Pal. New York, IV, 1867, p. 143, pl. 22, figs. 29–43.

Chonetes (Productella?) muricata Hall, Second Ann. Rep. N. Y. State Geol 1883, pl. 47, figs. 12, 16, 30, 38, 42.

Strophalosia? muricata Beecher, American Jour. Sci., 3d ser., XL, 1890, p. 24

Strophalosia muricata Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 31 pl. 16, figs. 12, 16, 30, 38, 42.

Loc. Ellington, New York, and Meadville, Pennsylvania.

Strophalosia nummulina A. Winchell. Kinderhook (L. Carb.)

Strophalosia? nummularis A. Winchell, Proc. Acad. Nat. Sci. Philadelphia 1863, p. 4.

Strophalosia? nummulina Beecher, American Jour. Sci., 3d ser., XL, 1890, p. 242

Strophalosia nummularis Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 316.

Loc. Burlington, Iowa.

Strophalosia radicans (A. Winchell). Hamilton (Dev.).

Crania radicans A. Winchell, Rep. Lower Peninsula Michigan, 1866, p. 92.

Strophalosia radicans Beecher, American Jour. Sci., 3d ser., XL, 1890, pp. 240, 243, pl. 9, figs. 14–17.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 316, pl. 15B, figs. 27–30.

Loc. Grand Traverse region, Michigan.

Strophalosia rockfordensis Hall and Clarke. Upper Devonian.

Strophalosia rockfordensis Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 316, 353, pl. 17A, figs. 1–3; Pt. II, 1895, pl. 84, figs. 20–22.

Loc. Rockford, Iowa.

Strophalosia scintilla Beecher. Chouteau (L. Carb.).

Strophalosia scintilla Beecher, American Jour. Sci., 3d ser., XL, 1890, p. 243, pl. 9, figs. 10–13.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 316, pl. 15B, figs. 32–34.

Loc. Pike County, Missouri.

Strophalosia spondyliformis (White and St. John). Upper Carboniferous.

Aulosteges spondyliformis White and St. John, Trans. Chicago Acad. Sci., I, 1868, p. 118, fig. 2.

Strophalosia spondyliformis (White and St. John)—Continued.

Strophalosia spondyliformis Beecher, American Jour. Sci., 3d ser., XL, 1890, p. 242.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 17A, figs. 25, 26.

Loc. Appanoose and Pottawattamie counties, Iowa.

Strophalosia truncata (Hall). Hamilton, Portage, and Ithaca (Dev.).

Strophomena pustulosa Hall (non Productus pustulosus Phillips), Geol. N. Y.; Rep. Fourth Dist., 1843, p. 189, fig. 4.

Productus truncatus Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 171.

Productella truncata Hall, Pal. New York, IV, 1867, p. 160, pl. 23, figs. 12–24;—Second Ann. Rep. N. Y. State Geol., 1883, pl. 48, figs. 10–15.—Kindle, Bull. American Pal., 6, 1896, p. 35.

Productus (P.) truncatus Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 131, pl. 14, fig. 2.

Productella (Strophalosia?) truncata Whiteaves, Cont. Canadian Pal., I, 1889, p. 112, pl. 16, figs. 1, 2.

Strophalosia truncata Beecher, American Jour. Sci., 3d ser., XL, 1890, p. 247.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 316, pl. 15B, figs. 24–26; pl. 17, figs. 10–15.

Loc. New York; Thedford, Ontario; Eureka district, Nevada.

STROPHEODONTA Hall. Genotype Strophomena demissa Conrad.

Stropheodonta Hall, Pal. New York, II, 1852, p. 63.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 284.

Strophodonta Hall, Geol. Survey Iowa, I, 1858, p. 491.—Billings, Canadian Jour. Sci. Arts, n. ser., VI, 1861, p. 332;—Proc. Portland Soc. Nat. Hist., 1863, p. 108.—Hall, Pal. New York, IV, 1867, p. 78.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 142.

Brachyprion Shaler, Bull. Mus. Comp. Zool., 4, 1865, p. 63.

Brachyprion and Douvilina Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 220, 286, 288, 289, 292; Eleventh Ann. Rep. N. Y. State Geologist, 1894, pp. 280, 281.

Stropheodonta acanthoptera (Whiteaves). Upper Silurian.

Strophomena acanthoptera Whiteaves, Canadian Rec. Sci., 1891, p. 294, pl. 3, figs. 1, 2.

Loc. District of Saskatchewan and Lake Winnipegosis, Canada.

Stropheodonta alveata Hall. Upper Helderberg (Dev.).

Strophodonta alveata Hall, Sixteenth Rep. N. Y. State Cab. Nat. Hist., 1863, p. 36;—Pal. New York, IV, 1867, p. 81, pl. 11, figs. 1–3.

Loc. Albany County, New York.

Stropheodonta arcuata Hall. Chemung (Dev.).

Strophodonta arcuata Hall, Geol. Survey Iowa, I, 1858, p. 492, pl. 3, figs. 1a–1c, 2a–2f.—Calvin, Bull. U. S. Geol. Survey, IV, 1878, p. 728.—Whiteaves, Cont. Canadian Pal., I, 1892, p. 285.

Strophodonta arcuata? Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 121.

Stropheodonta arcuata Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 289, pl. 15B, figs. 1–3.

Loc. Rockford, Iowa; Naples, New York; Eureka district, Nevada; Lake Winnipegosis, Canada.

Stropheodonta beckei Hall. Lower Helderberg (Dev.).

Strophodonta beckii Hall, Pal. New York, III, 1859, p. 191, pl. 22, figs. 1a–1t.—Meek, American Jour. Sci., 2d ser., XL, 1865, p. 33.—Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 44, figs. 23, 24.

Strophomena (Strophodonta) beckii Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 52, figs. 1–4.

Stropheodonta beckei Hall—Continued.

Stropheodonta (Leptostrophia) becki Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 288, pl. 13, figs. 23, 24.

Loc. Albany and Schoharie counties, New York; Kennedy Channel, Arctic region.

Stropheodonta blainvillei (Billings). Lower Devonian.

Strophomena blainvillei Billings, Pal. Fossils, II, 1874, p. 28, pl. 2, fig. 1; pl. 3, fig. 1.

Stropheodonta (Leptostrophia) blainvillii Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 288.

Loc. Gaspé, Canada.

Obs. Compare with S. perplana.

Stropheodonta callawayensis Swallow. Hamilton (Dev.).

Strophodonta callawayensis, quadrata, and æquicostata Swallow, Trans. St. Louis Acad. Sci., I, 1860, p. 638.

Loc. Callaway County, Missouri.

Obs. See S. navalis.

Stropheodonta callosa Hall. Upper Helderberg (Dev.).

Strophodonta callosa Hall, Sixteenth Rep. N. Y. State Cab. Nat. Hist., 1863, p. 36;—Pal. New York, IV, 1867, p. 82, pl. 11, figs. 4–10; pl. 12, figs. 8, 9.

Chonetes (Strophodonta?) callosa Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 47, fig. 37.

Stropheodonta callosa Hall and Clarke, VIII, Pt. I, 1892, pl. 16, fig. 37.

Loc. Albany County, New York.

Stropheodonta calvini Miller. Chemung (Dev.).

Strophodonta quadrata Calvin (non Swallow, 1860), Bull. U. S. Geol. Geogr. Survey Terr., IV, 1878, p. 728.

Strophodonta calvini Miller, Cat. American Pal. Foss., 2d ed., January, 1883, p. 298.—Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 122, pl. 13, fig. 6.

Strophodonta exilis Calvin, American Jour. Sci., 3d ser., XXV, June, 1883, p. 443.

Loc. Rockford and Independence, Iowa; Eureka district, Nevada.

Stropheodonta canace Hall and Whitfield. Chemung (Dev.).

Strophodonta canace Hall and Whitfield, Twenty-third Rep. N. Y. State Cab. Nat. Hist., 1873, p. 236, pl. 11, figs. 8–11; abstract of same in 1872;—King's U. S. Geol. Expl. 40th Parl., IV, 1877, p. 246, pl. 3, figs. 1–3.

Loc. Rockford, Iowa; White Pine district, Nevada; Naples, New York.

Stropheodonta cincta A. Winchell. Hamilton (Dev.).

Strophodonta cincta A. Winchell, Rep. Lower Peninsula Michigan, 1866, p. 93.

Loc. Grand Traverse region, Michigan.

Obs. Insufficiently defined to be recognized.

Stropheodonta concava Hall. Corniferous and Hamilton (Dev.).

Strophomena (Strophodonta) concava Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, pp. 115, 140, fig. 1.

Strophodonta concava Hall, Pal. New York, IV, 1867, p. 96, pl. 16, figs. 1a–1h;—Second Ann. Rep. N. Y. State Geol., 1883, pl. 45, figs. 16–22.

Stropheodonta concava Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 14, figs. 16–23.

Loc. New York, from Cayuga Lake westward to Lake Erie.

Stropheodonta corrugata (Conrad). Clinton (Sil.).

Strophomena corrugata Conrad, Jour. Acad. Nat. Sci. Philadelphia, VIII, 1842, p. 256, pl. 14, fig. 8.—Hall, Geol. N. Y.; Rep. Fourth Dist., 1843, p. 73, fig. 2 on p. 72;—Twelfth Rep. N. Y. State Cab. Nat. Hist., 1859, p. 82.—Foerste, Proc. Boston Soc. Nat. Hist., XXIV, 1890, p. 303, pl. 6, fig. 25.

Stropheodonta corrugata (Conrad)—Continued.

Leptæna corrugata Hall, Pal. New York, II, 1852, p. 59, pl. 21, figs. 2a–2c.

Strophodonta corrugata Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 46, fig. 1.

Stropheodonta corrugata Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 15, fig. 1; Pt. II, 1895, pl. 84, fig. 14.

Loc. Rochester, Wolcott, etc., New York; Cumberland Gap, Tennessee.

Stropheodonta (?) corrugata pleuristriata (Foerste.) Clinton (Sil.).

Leptæna corrugata (partim) Hall, Pal, New York, II, 1852, p. 59, pl. 21, figs. 2d, 2e.

Strophomena corrugata var. pleuristriata Foerste, Proc. Boston Soc. Nat. Hist., XXIV, 1890, p. 303, pl. 6, figs. 26, 27.

Loc. Cumberland Gap, Tennessee.

Stropheodonta (?) costata Owen. Hamilton (Dev.).

Strophodonta (?) costata Owen, Geol. Survey Wisconsin, Iowa, and Minnesota, 1852, p. 585, pl. 3A, fig. 5; pl. 3, figs. 11, 11a.

Loc. Davenport, Iowa.

Stropheodonta crebristriata Hall. Upper Helderberg (Dev.).

Strophomena crebristriata Conrad, Jour. Acad. Nat. Sci. Philadelphia, VIII, 1842, p. 254, pl. 14, fig. 3.

Strophodonta crebristriata Hall, Sixteenth Rep. N. Y. State Cab. Nat. Hist., 1863, p. 37;—Pal. New York, IV, 1867, p. 86, pl. 11, figs. 12, 13, 18–21.

Loc. Albany and Schoharie counties, New York.

Stropheodonta demissa (Conrad). Middle and Upper Devonian.

Strophomena demissa Conrad, Jour. Acad. Nat. Sci. Philadelphia, VIII, 1842, p. 258, pl. 14, fig. 14.—Rogers, Geol. Pennsylvania, II, 1858, p. 827, fig. 666.—Billings, Canadian Jour. Sci. Arts, 2d ser., VI, 1861, p. 341, figs. 116–118;—Geol. Canada, 1863, p. 367, figs. 377a–d.

Strophodonta dimosa(?) Owen, Geol. Survey Wisconsin, Iowa, and Minnesota, 1852, tab. 3A, fig. 14. [See specimens in U. S. Nat. Mus., Cat. Invert. Foss., 17917.]

Strophomena (Strophodonta) demissa Hall, Tenth Rep N. Y. State Cab. Nat. Hist., 1857, p. 137, fig. 1.—Meek, Trans. Chicago Acad. Sci., I, 1868, p. 87, figs. 6a–c.

Strophomena (Strophodonta) subdemissa Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 145.—Meek (non Hall), Trans. Chicago Acad. Sci., I, 1868, p. 88, pl. 13, fig. 7.

Strophodonta demissa Hall, Geol. Survey Iowa, I, Pt. II, 1858, p. 495, pl. 3, fig. 5;—Pal. New York, IV, 1867, p. 81, pl. 11, figs. 14–17; pl. 12, figs. 1–5.—Nicholson, Pal. Prov. Ontario, 1873, p. 65.—White, Second Ann. Rep. Indiana Bureau of Statistics and Geol., 1880, p. 500, pl. 4, figs. 6, 7;—Tenth Rep. Indiana State Geol., 1881, p. 132, pl. 4, figs. 6, 7.—Whitfield, Geol. Wisconsin, IV, 1882, p. 327, pl. 25, fig. 18.—Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 45, figs. 7–12.—Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 118, pl. 2, fig. 9.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 143, pl. 18, figs. 10–16; pl. 33, fig. 22.—Whiteaves, Cont. Canadian Pal., I, 1891, p. 219.—Keyes, Geol. Survey Missouri, V, 1895, p. 70, pl. 39, fig. 7.

Stropheodonta demissa Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 14, figs. 7–12.

Loc. New York; Pennsylvania; Ohio; Indiana; Kentucky; Illinois; Iowa; Wisconsin; Ontario; Mackenzie and Athabasca rivers, Canada; Eureka district, Nevada.

Stropheodonta demissa imitata Winchell. Hamilton (Dev.).

Strophodonta imitata A. Winchell, Rep. Lower Peninsula Michigan, 1866, p. 93.

Loc. Grand Traverse region, Michigan.

Stropheodonta erratica A. Winchell. Hamilton (Dev.).

Strophodonta erratica and varieties solidicosta and fissicosta A. Winchell, Rep. Lower Peninsula Michigan, 1866, p. 93.

Loc. Grand Traverse region, Michigan.

Obs. This species may prove to be only a local variation of S. costata Owen.

Stropheodonta feildeni Etheridge. ? Lower Devonian.

Strophodonta feildeni Etheridge, Quart. Jour. Geol. Soc. London, XXXIV, 1878, p. 598, pl. 25, fig. 4.

Loc. Cape Hilgard, lat. 79° 41′.

Obs. Since this species is very closely related to S. magnifica of the Oriskany sandstone the horizon is probably Lower Devonian.

Stropheodonta galatea (Billings). Lower Devonian.

Strophomena galatea Billings, Pal. Fossils, II, 1874, p. 20, fig. 9.

Loc. Indian Cove, Gaspé, Canada.

Stropheodonta (?) geniculata (Shaler). Anticosti (Sil.).

Brachyprion geniculatum Shaler, Bull. Mus. Comp. Zool., 4, 1865, p. 63.

Loc. Near Southwest Point, Anticosti.

Stropheodonta (?) gilpeni (Dawson). Upper Arisaig (Sil.).

Strophomena gilpeni Dawson, Canadian Nat. Geol., n. ser., IX, 1880, p. 341.

Loc. Nova Scotia, Canada.

Stropheodonta hemispherica Hall. Upper Helderberg (Dev.)

Strophomena (Strophodonta) hemispherica Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 113.

Strophodonta hemispherica Hall, Pal. New York, IV, 1867, p. 90, pl. 13, figs. 12, 13;—Second Ann. Rep. N. Y. State Geol., 1883, pl. 45, fig. 23.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 144, pl. 18, figs. 4-6.

Loc. New York; Ohio; Indiana; Kentucky; Ontario.

Stropheodonta inæquiradiata Hall. Upper Helderberg (Dev.).

Strophomena (Strophodonta) inæquiradiata Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 113, figs. 1–3.

Strophomena inæquistriata Billings, Canadian Jour. Sci. Arts, VI, 1861, p. 338, fig. 113;—Geol. Canada, 1863, p. 367, fig. 375;—Pal. Fossils, II, 1874, p. 24, fig. 13; pl. 2, fig. 4; p. 240.

Strophodonta inæquiradiata Hall, Pal. New York, IV, 1867, p. 87, pl. 11, figs. 24–31; pl. 12, fig. 12; pl. 13, figs. 6–11;—Second Ann. Rep. N. Y. State Geol., 1883, pl. 45, figs. 13, 14.—Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 120, pl. 11, fig. 11.

Stropheodonta inæquiradiata Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 14, figs. 13, 14.

Loc. Albany and Schoharie counties, New York; Columbus, Ohio; Eureka district, Nevada; Gaspé Bay, Canada.

Stropheodonta inæquistriata (Conrad). Corniferous to Hamilton (Dev.).

Strophomena inæquistriata Conrad, Jour. Acad. Nat. Sci. Philadelphia, VIII, 1842, p. 254, pl. 14, fig. 2.—Hall, Geol. N. Y.; Rep. Fourth Dist., 1843, p. 200, fig. 4.—Billings, Canadian Jour. Sci. Arts, VI, 1861, p. 338, figs. 113, 114;—Geol. Canada, 1863, p. 367, fig. 375.

Strophomena (Strophodonta) inæquistriata Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 142.

Strophodonta inæquistriata Hall, Pal. New York, IV, 1867, p. 93, pl. 12, figs. 6–8; p. 106, pl. 18, fig. 2;—Second Ann. Rep. N. Y. State Geol., 1883, pl. 45, figs. 1–6.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 145, pl. 17, figs. 10, 11.

Stropheodonta inæquistriata (Conrad)—Continued.

Stropheodonta (Douvillina) inæquistriata Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 289, pl. 14, figs. 1–6; pl. 15B, fig. 9.

Loc. Caledonia, Moscow, Darien, etc., New York; Ontario, Canada; Milwaukee, Wisconsin; Falls of Ohio.

Stropheodonta indenta (Conrad). Lower Helderberg (Dev.).

Leptæna indenta Conrad, Second Ann. Rep. N. Y. Geol. Survey, 1838, pp. 112, 117.

Strophomena indenta Billings, Proc. Portland Soc. Nat. Hist., 1863, p. 109, pl. 3, fig. 3.

Strophodonta indenta Miller, American Pal. Fossils, 1877, p. 135.

Loc. "Helderberg Mountains," New York; Square Lake, Maine; Gaspé, Canada.

Stropheodonta interstrialis (Phillips). Middle Devonian.

Orthis interstrialis Phillips, Pal. Foss. Cornw. and W. Somerset, 1841, p. 61, pl. 25, fig. 103.

Strophodonta interstrialis Whiteaves, Cont. Canadian Pal., I, 1892, p. 286, pl. 37, fig. 6.

Loc. Europe; Lake Winnipegosis, Canada.

Stropheodonta interstrialis (Vanuxem). Ithaca (Dev.).

Strophomena interstrialis Vanuxem (non Phillips), Geol. N. Y.; Rep. Third Dist. 1842, p. 174, fig. 1.

Strophodonta mucronata Hall, Pal. New York, IV, 1867, p. 111, pl. 15, figs. 13, 14.

Loc. Ithaca, Elmira, Bath, etc., New York.

Obs. My attention was directed to the above synonymy by Professor Williams and as well that of S. mucronata Conrad (non Hall).

Stropheodonta iowaensis Owen. ?Upper Devonian.

Strophodonta iowensis Owen, Geol. Survey Wisconsin, Iowa, and Minnesota, 1852, p. 585.

Loc. Pine Creek, near Rockford, Iowa.

Stropheodonta irene (Billings). Upper Helderberg (Dev.).

Strophomena irene Billings, Pal. Fossils, II, 1874, p. 27, pl. 2, fig. 5.

Stropheodonta (Leptostrophia) irene Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 288.

Loc. Grand Greve, Gaspé Bay, Canada.

Stropheodonta junia Hall. Hamilton (Dev.).

Strophomena (Strophodonta) textilis Hall (non 1852), Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 141, figs. 1–3.

Strophodonta textilis Hall, Pal. New York, IV, 1867, p. 108, pl. 18, figs. 3, 4.

Strophodonta junia Hall, Ibidem, 1867, corrigenda;—Second Ann. Rep. N. Y. State Geologist, 1883, pl. 46, fig. 16.

Stropheodonta (Leptostrophia) junia Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 288, pl. 15, fig. 16.

Loc. York, Moscow, Darien, etc., New York.

Stropheodonta kemperi Swallow. Hamilton (Dev.).

Strophodonta kemperi Swallow, Trans. St. Louis Acad. Sci., I, 1860, p. 636.

Loc. Callaway County, Missouri.

Stropheodonta(?) leda (Billings). Anticosti (Sil.).

Strophomena leda Billings, Canadian Nat. and Geol., V, 1860, p. 55, figs. 2, 3;—Pal. Fossils, I, 1862, p. 120, figs. 98, 99;—Geol. Canada, 1863, p. 311, fig. 316.

Brachyprion leda Shaler, Bull. Mus. Comp. Zool., 4, 1865, p. 63.

Stropheodonta leda Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 288.

Rafinesquina leda Whiteaves, Pal. Foss. III, Pt. III, 1897, p. 172.

Loc. East Point, Anticosti, Lake Winnepeg, Manitoba.

Stropheodonta lincklæni Hall. Oriskany (Dev.).

Strophodonta lincklæni Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 55;—Pal. New York, III, 1859, p. 415, pl. 93, figs. 2, 3.

Loc. Albany and Schoharie counties, New York.

Stropheodonta macra (Winchell and Marcy). Niagara (Sil.).

Strophomena macra W. and M., Mem. Boston Soc. Nat. Hist., I, 1865, p. 91.—Hall, Twentieth Rep. N. Y. State Cab. Nat. Hist., 1867, p. 392.

Loc. Probably near Chicago, Illinois.

Stropheodonta macrostriata (Walcott). Lower Devonian.

Chonetes macrostriata Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 126, pl. 2, fig. 13; pl. 13, fig. 14.

Loc. Eureka district, Nevada.

Obs. The type material proves it to be a Stropheodonta.

Stropheodonta magnifica Hall. Oriskany (Dev.).

Strophodonta magnifica Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 54;—Pal. New York, III, 1859, pp. 414, 482, pl. 93, fig. 4; pl. 94, fig. 2; pl. 95, fig. 8; pl. 95A, figs. 15–19;—Second Ann. Rep. N. Y. State Geol., 1883, pl. 44, figs. 27, 28.

Strophomena magnifica Billings, Canadian Jour. Sci. Arts, VI, 1861, p. 348;—Geol. Canada, 1863, p. 961, fig. 468.

Stropheodonta (Leptostrophia) magnifica Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 288, pl. 13, figs. 27, 28.

Loc. Albany and Schoharie counties, New York; Cumberland, Maryland; county of Haldimand, Ontario, Canada.

Stropheodonta magniventer Hall. Oriskany (Dev.).

Strophodonta magniventra Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 54;—Pal. New York, III, 1859, p. 411, pl. 92, figs. 2, 3; pl. 95, fig. 9;—Second Ann. Rep. N. Y. State Geol., 1883, pl. 44, figs. 25, 26.

Strophomena magniventra Billings, Canadian Jour. Sci. Arts, VI, 1861, p. 349;—Geol. Canada, 1863, p. 961, fig. 469;—Pal. Fossils, II, 1874, p. 22, figs. 10–12, and pl. 2, fig. 2.

Stropheodonta (Leptostrophia) magniventra Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 288, pl. 13, figs. 25, 26.

Loc. Albany and Schoharie counties, New York; Cayuga, Ontario, and Gaspé Bay, Canada.

Stropheodonta mucronata (Conrad). Portage and Chemung (Dev.).

Strophomena mucronata Conrad, Jour. Acad. Nat. Sci. Philadelphia, VIII, 1842, p. 257, pl. 14, fig. 10.

Strophomena interstrialis Hall, Geol. N. Y.; Rep. Fourth Dist., 1843, p. 266, fig. 5.

Strophodonta cayuta Hall, Pal. New York, IV, 1867, p. 110, pl. 19, figs. 1–5;—Second Ann. Rep. N. Y. State Geol., 1883, pl. 46, figs. 18, 19.

Stropheodonta (Douvillina) cayuta Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 289, pl. 15, figs. 18, 19; pl. 15B, figs. 7, 8; Pt. II, 1895, pl. 84, fig. 13.

Loc. Steuben County, New York.

Obs. See S. interstrialis.

Stropheodonta navalis Swallow. Hamilton (Dev.).

Strophodonta navalis, cymbiformis, subcymbiformis, and altidorsata Swallow, Trans. St. Louis Acad. Sci., I, 1860, pp. 635, 636, 637.

Strophodonta cymbiformis Keyes, Geol. Survey Missouri, V, 1895, p. 74.

Loc. Callaway County, Missouri.

Obs. The ten species of Stropheodonta described in this transaction by Swallow are all from one locality and appear to be nothing more than peculiar variations of S. demissa Conrad. No other locality is known where a species

Strophodonta navalis Swallow—Continued.

of Brachiopoda has taken on as many variations as has S. demissa in the vicinity of Fulton, Missouri. Mr. D. K. Greger has furnished the writer over one hundred examples of this species and no two are exactly alike. Swallow's ten species are here reduced to three and one variety: S. navalis and var. boonensis, S. kemperi, and S. callawayensis.

Keyes (Geol. Survey Missouri, V, 1895) regards S. navalis, callawayensis, quadrata, and æquicostata as synonyms for S. demissa, while S. cymbiformis, subcymbiformis, kemperi, inflexa, and boonensis are regarded by him as but one species, S. cymbiformis. S. altidorsata is regarded as "insufficiently described."

Strophodonta navalis boonensis Swallow. Hamilton (Dev.).

Strophodonta boonensis and inflexa Swallow Trans. St. Louis Acad. Sci., I, 1860, pp. 637, 638.

Loc. Callaway County, Missouri.

Strophodonta nearpassi Barrett. Coralline limestone (Sil.).

Leptæna——Hall, Pal. New York, II, 1852, pl. 74, fig. 3.

Strophodonta nearpassi Barrett, American Jour. Sci., 3d ser., XV, 1878, p. 372.

Loc. Near Port Jervis, New York.

Strophodonta parva Owen. Hamilton (Dev.).

Strophodonta parva Owen, Geol. Survey Wisconsin, Iowa, and Minnesota, 1852, p. 584, pl. 3A, fig. 9.

Loc. New Buffalo, Iowa.

Obs. This may prove to be young S. demissa.

Strophodonta parva Hall. Upper Helderberg (Dev.).

Strophodonta parva Hall, Sixteenth Rep. N. Y. State Cab. Nat. Hist., 1863, p. 37;—Pal. New York, IV, 1867, p. 85, pl. 11, figs. 5, 11.

Loc. Albany and Schoharie counties, New York.

Strophodonta patersoni Hall. Oriskany to Corniferous (Dev.).

Strophomena (Strophodonta) patersoni Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 114, figs. 1-5.

Strophomena ? patersoni Billings, Canadian Jour. Sci. Arts, 2d ser., VI, 1861, p. 340, fig. 115.

Strophomena patersoni Billings, Geol. Canada, 1863, p. 367, fig. 374.—Nicholson, Pal. Prov. Ontario, 1873, p. 67.

Strophodonta patersoni Hall, Pal. New York, IV, 1867, p. 89, pl. 12, figs. 9-11; pl. 13, figs. 1-5;—Second Ann. Rep. N. Y. State Geol., 1883, pl. 45, fig. 15.—Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 119.

Strophodonta patersoni Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 14, fig. 15.

Loc. Schoharie, Stafford, Williamsville, etc., New York; Columbus, Ohio; Bakeoven, Illinois; Eureka district, Nevada; county of Haldimand, Ontario, Canada.

Strophodonta perplana (Conrad). Upper Helderberg-Chemung (Dev.).

Strophomena perplana Conrad, Jour. Acad. Nat. Sci. Philadelphia, VIII, 1842, p. 257, pl. 14, fig. 11.—Rogers, Geol. Pennsylvania, II, Pt. II, 1858, p. 827, fig. 665.—Billings, Canadian Jour. Sci. Arts, 2d ser., VI, 1861, p. 343;—Proc. Portland Soc. Nat. Hist., 1863, p. 109.—Nicholson, Pal. Prov. Ontario, 1873, p. 64.

Strophomena delthyris Conrad, Jour. Acad. Nat. Sci. Philadelphia, VIII, 1842 p. 258, pl. 14, fig. 19.

Strophomena pluristriata Conrad, Ibidem, 1842, p. 259.

Strophomena crenistria Hall, Geol. N. Y.; Rep. Fourth Dist., 1843, p. 171, fig. 4.

Stropheodonta perplana (Conrad)—Continued.

Strophomena (Strophodonta) crenistria Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 111.

Strophomena (Strophodonta) fragilis Hall, Ibidem, 1857, p. 143.

Strophodonta fragilis Hall, Geol. Iowa, I, Pt. II, 1858, p. 496, pl. 3, fig. 6.

Strophodonta perplana Hall, Pal. New York, IV, 1867, pp. 92, 98, pl. 11, fig. 22; pl. 12, figs. 13–15; pl. 17, fig. 1.—Rathbun, Proc. Boston Soc. Nat. Hist., XX, 1879, p. 25.—Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 46, figs. 2–15.—Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 120, pl. 13, fig. 11.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 147, pl. 18, fig. 17.—Beecher, American Jour. Sci., 3d ser., XLI, 1891, p. 357, pl. 17, fig. 17.—Whiteaves, Cont. Canadian Pal., I, 1891, p. 220.

Stropheodonta (Leptostrophia) perplana Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 288, pl. 15, figs. 2–13.

Loc. New York; Pennsylvania; Maryland; Ohio; Indiana; Kentucky; Illinois; Iowa; Wisconsin; Eureka district, Nevada; Square Lake, Maine; Ontario and Peace River, Canada; Rio Maecuru and Rio Curua, Province of Para, Brazil.

Stropheodonta perplana nervosa Hall. Portage and Chemung (Dev.).

Strophomena nervosa Hall, Geol. N. Y.; Rep. Fourth Dist., 1843, p. 266, fig. 1.

Strophodonta perplana var. nervosa Hall, Pal. New York, IV, 1867, p. 113, pl. 19, figs. 13–16;—Second Ann. Rep. N. Y. State Geol., 1883, pl. 46, fig. 17.

Stropheodonta perplana var. nervosa Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, figs. 14, 15, 17.

Loc. Ithaca, Bath, Campbelltown, etc., New York.

Stropheodonta perplana tulliensis Williams. Tully (Dev.).

Strophodonta perplana var. tulliensis Williams, Bull. Geol. Soc. America, I, 1890, p. 493, pl. 12, figs. 1–4.

Loc. Cuyler, New York.

Stropheodonta planulata Hall. Lower Helderberg (Dev.).

Strophodonta planulata Hall, Pal. New York, III, 1859, p. 184, pl. 16, figs. 9–12.

Loc. Schoharie, Dryhill, and Litchfield, New York.

Stropheodonta plicata Hall. Hamilton (Dev.).

Strophodonta plicata Hall, Thirteenth Rep. N. Y. State Cab. Nat. Hist., 1860, p. 90;—Pal. New York, IV, 1867, p. 114.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 149.

Loc. Iowa City and Independence, Iowa; Thedford, Ontario; Falls of Ohio.

Stropheodonta prisca Hall. Clinton (Sil.).

Stropheodonta prisca Hall, Pal. New York, II, 1852, p. 63, pl. 21, fig. 9.

Loc. Kirkland, Oneida County, New York.

Stropheodonta profunda Hall. Clinton and Niagara (Sil.).

Leptæna profunda Hall, Pal. New York, II, 1852, p. 61, pl. 21, figs. 4, 5.

Strophomena profunda Hall, Twelfth Rep. N. Y. State Cab. Nat. Hist., 1859, p. 82.

Strophomena niagarensis Winchell and Marcy, Mem. Boston Soc. Nat. Hist., I, 1865, p. 92, pl. 2, fig. 9.

Strophodonta profunda Hall, Twentieth Rep. N. Y. State Cab. Nat. Hist., 1867, pp. 369, 392, pl. 13, figs. 3, 4;—Twenty-eighth Rep. N. Y. State Mus. Nat. Hist., 1879, p. 151, pl. 23, figs. 9, 10;—Eleventh Rep. Indiana State Geol., 1882, p. 289, pl. 23, figs. 9, 10; pl. 27, fig. 18;—Second Ann. Rep. N. Y. State Geol., 1883, pl. 44, figs. 1–5 (? figs. 19, 20).—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 148, pl. 29, fig. 26; pl. 17, figs. 20, 21.

Stropheodonta profunda Hall—Continued.

Stropheodonta (Brachyprion) profunda Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 13, figs. 1–5 (? 19, 20); pl. 20, figs. 29–31; Pt. II, 1895, pl. 84, fig. 12.

Loc. Lockport, New York; Waldron, Indiana; Bridgeport, Illinois; Racine, Wisconsin; Louisville, Kentucky.

Stropheodonta textilis Hall. Coralline (Sil.).

Stropheodonta textilis Hall, Pal. New York, II, 1852, p. 327, pl. 74, fig. 6.

Stropheodonta (Leptostrophia) textilis Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 288.

Loc. Schoharie, New York.

Stropheodonta tullia (Billings). Upper Helderberg (Dev.).

Strophomena tullia Billings, Pal. Fossils, II, 1874, p. 29, pl. 2, fig. 6.

Stropheodonta (Leptostrophia) tullia Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 288.

Loc. Mount Joli and Split Rock, Percé, Canada.

Stropheodonta variabilis Calvin. Chemung (Dev.).

Strophodonta variabilis Calvin, Bull. U. S. Geol. Geogr. Survey Terr., IV, 1878, p. 727.

Stropheodonta variabilis Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 289, pl. 15B, figs. 4–6.

Loc. Independence, Iowa; Naples, New York.

Stropheodonta varistriata (Conrad). Lower Helderberg (Dev.).

Strophomena varistriata Conrad, Jour. Acad. Nat. Sci. Philadelphia, VIII, 1842, p. 255, pl. 14, fig. 6.—Billings, Pal. Fossils, II, 1874, p. 26, pl. 2, fig. 3.

Strophomena rectilateris Conrad, Jour. Acad. Nat. Sci. Philadelphia, VIII, 1812, p. 255, pl. 14, fig. 7.

Strophomena impressa Conrad, Ibidem, 1842, p. 255.

Strophodonta varistriata Hall, Pal. New York, III, 1859, p. 180, pl. 8, figs. 1–16; pl. 16, figs. 1–8;—Second Ann. Rep. N. Y. State Geol., 1883, pl. 44, figs. 6–16 (? figs. 21, 22).

Stropheodonta (Brachyprion) varistriata Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 13, figs. 6–16, 21, 22.

Loc. Albany and Schoharie counties, New York; Dalhousie, New Brunswick, and Gaspé, Canada.

Stropheodonta varistriata arata Hall. Lower Helderberg (Dev.).

Strophodonta varistriata var. arata Hall, Pal. New York, III, 1859, p. 183, pl. 18, fig. 1;—Second Ann. Rep. N. Y. State Geol., 1883, pl. 44, figs. 17, 18.

Stropheodonta varistriata var. arata Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 13, figs. 17, 18.

Loc. Hudson and Albany counties, New York; Arisaig, Nova Scotia (Ami).

Stropheodonta vascularia Hall. Oriskany (Dev.).

Strophodonta vascularia Hall, Pal. New York, III, 1859, p. 412, pl. 92, fig. 4; pl. 95, fig. 10 (? pl. 93, fig. 2).

Loc. Albany County, New York.

Stropheodonta (?) ventricosa (Shaler). Anticosti (Sil.).

Brachyprion ventricosa Shaler, Bull. Mus. Comp. Zool., 4, 1865, p. 63.

Loc. Southwest Point, Anticosti.

Strophodonta æquicostata Swallow=S. callawayensis.

Strophodonta altidorsata Swallow=S. navalis.

Strophodonta ampla Hall=Strophonella ampla.

Strophodonta boonensis Swallow=S. navalis boonensis.
Strophodonta cælata Hall=Strophonella cælata.
Strophodonta cavumbona Hall=Strophonella cavumbona.
Strophodonta cayuta Hall=Stopheodonta mucronata.
Strophodonta cymbiformis Swallow=S. navalis.
Strophodonta exilis Calvin=Stropheodonta calvini.
Strophodonta fragilis Hall=S. perplana.
Strophodonta geniculata Hall=Strophonella geniculata.
Strophodonta headleyana Hall=Strophonella headleyana.
Strophodonta hybrida Hall and Whitfield=Strophonella reversa.
Strophodonta imitata A. Winchell=S. demissa imitata.
Strophodonta inflexa Swallow=S. navalis boonensis.
Strophodonta intermedia Hall=Hipparionyx proximus.
Strophodonta leavenworthana Hall=Strophonella leavenworthana.
Strophodonta mucronata Hall=S. interstrialis.
Strophodonta nacrea Hall=Pholidostrophia iowaensis.
Strophodonta punctulifera Hall=Strophonella punctulifera.
Strophodonta quadrata Swallow=S. callawayensis.
Strophodonta quadrata Calvin (non Swallow)=S. calvini.
Strophodonta reversa Hall=Strophonella reversa.
Strophodonta striata Hall=Strophonella striata.
Strophodonta subcymbiformis Swallow=S. navalis.
Strophodonta subdemissa Hall=S. demissa.
Strophodonta textilis Hall, 1857 (not 1852)=S. junia.

STROPHOMENA (Rafinesque) Blainville. Genotype S. rugosa Blainv.

Strophomena Blainville, Manuel de Malacologie et Conchyliologie, I, 1825, p. 513, pl. 53, fig. 2.—Defrance, Dictionnaire des Sciences Naturelles, LI, 1827, p. 151 and atlas.—King, Mon. Permian Fossils, Pal. Soc., 1850, p. 103.—Meek (partim), Pal. Ohio, I, 1873, p. 73.—Œhlert, Fischer's Manuel de Conchyliologie, 1887, p. 1281.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 245.—Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 384.—Hall and Clarke, Eleventh Ann. Rep. N. Y. State Geologist, 1894, p. 283.

Strophomenes Rafinesque, Desc. Remarkable Objects in the Cabinet of Professor Rafinesque, 1831, p. 4.

Hemipronites Meek and Hayden, Pal. Upper Missouri, Smithsonian Cont. to Knowl. XIV, 172, 1864, p. 24.—Miller, Cincinnati Quart. Jour. Sci., II, 1875, p. 41.

Obs. This genus is characteristic of the Ordovician, and probably does not extend into the Silurian, where Orthothetes replaces Strophomena. A number of Silurian species are still left under Strophomena since their generic characters are unknown.

Strophomena acanthoptera Whiteaves=Stropheodonta acanthoptera.
Strophomena acutiradiata Hall=Chonetes acutiradiatus.
Strophomena alternata Emmons=Rafinesquina alternata.
Strophomena alternata fracta Meek=Rafinesquina alternata fracta.
Strophomena alternata loxorhytis Meek=Rafinesquina alternata loxorhytis.
Strophomena alternistriata Hall=Rafinesquina alternata alternistriata.

Strophomena (?) alterniradiata Shaler. Anticosti (Sil.).

Strophomena alterniradiata Shaler, Bull. Mus. Comp. Zool., 4, 1865, p. 63.

Loc. Southwest Point, Anticosti.

Strophomena ampla Hall=Strophonella ampla.

Strophomena anologa Davidson, 1863=Leptæna rhomboidalis.

Strophomena angulata Owen=Rafinesquina alternata.

Strophomena anticostiensis Shaler=Rafinesquina alternata.

Strophomena (?) antiquata Sowerby. Anticosti (Sil.).

Strophomena antiquata Sowerby, Murchison's Silurian System, 1839.—Billings, Pal. Fossils, I, 1862, p. 129, fig. 107.

Loc. Europe; Anticosti; forks of the Chatts River, Gaspé.

Obs. This identification is doubtful.

Strophomena approximata (James). Lorraine (Ord.).

Streptorhynchus approximata James, The Paleontologist, 5, 1881, p. 43; 2, 1878, p. 15.

Loc. Dearborn County, Indiana.

Obs. Not defined so as to be recognizable.

Strophomena arctostriata Hall=Orthothetes chemungensis arctostriatus.

Strophomena (?) arcuata Shaler. Anticosti (Sil.).

Strophomena arcuata Shaler, Bull. Mus. Comp. Zool., 4, 1865, p. 62.

Loc. Ellis Bay, Anticosti.

Strophomena (?) arethusa Billings. Lorraine (Ord.).

Strophomena arethusa Billings, Pal. Fossils, I, 1862, p. 132.

Loc. Observation Cape, Anticosti.

Strophomena atava Matthew=Rafinesquina atava.

Strophomena aurora Billings=Rafinesquina aurora.

Strophomena bifurcata Hall=Orthothetes chemungensis.

Strophomena billingsi Winchell and Schuchert. Trenton (Ord.).

Strophomena recta Billings (non Conrad), Pal. Fossils, I, 1862, p. 130, fig. 108.

Strophomena billingsi W. and S., Minnesota Geol. Survey, III, 1893, p. 397, fig. 32.—Whiteaves, Pal. Foss., III, Pt. III, 1897, p. 170.

Loc. Ottawa, Canada; St. Paul, Cannon Falls, and Fountain, Minnesota; East Selkirk, Manitoba.

Strophomena (?) bipartita Hall. Coralline (Sil.).

Leptæna bipartita Hall, Pal. New York, II, 1852, p. 326, pl. 74, figs. 4, 5.

Strophomena bipartita Hall, Twelfth Rep. N. Y. State Cab. Nat. Hist., 1859, p. 82.

Loc. Schoharie, New York.

Strophomena blainvillii Billings=Stropheodonta blainvillei.

Strophomena camerata Conrad=Rafinesquina deltoidea.

Strophomena cardinalis (Whitfield). Lorraine (Ord.).

Streptorhynchus cardinale Whitfield, Geol. Wisconsin, IV, 1882, p. 261, pl. 12, figs. 9, 10.

Strophomena cardinale Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 252.

Loc. Delafield, Wisconsin.

Strophomena carinata Conrad, 1838=Tropidoleptus carinatus.

Strophomena carinata Conrad, 1842 (non 1838)=Chonetes coronatus.

Strophomena ceres Billings=Rafinesquina ceres.

Strophomena chemungensis Conrad=Orthothetes chemungensis.

Strophomena concava Hall=Stropheodonta concava.

Strophomena conradi Hall (1859)=Strophonella conradi.

Strophomena conradi Hall and Clarke. Trenton (Ord.).

Strophomena conradi Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 344, pl. 9A, fig. 3; pl. 20, figs. 32, 33.

Loc. Jacksonburg, New York.

Strophomena convexa Owen=S. incurvata.

Strophomena cornuta Hall=Chonetes cornutus.

Strophomena corrugata Conrad=Stropheodonta corrugata.

Strophomena crebristriata Conrad=Stropheodonta crebristriata.

Strophomena crenistria Hall=Stropheodonta perplana.

Strophomena (?) declivis James. Lorraine (Ord.).

Strophomena declivis James, Cincinnati Quart. Jour. Sci., I, 1874, p. 240.

Loc. Boyds Station, Kentucky.

Strophomena deflecta Conrad=Dinorthis deflecta.

Strophomena delthyris Conrad=Stropheodonta perplana.

Strophomena deltoidea Conrad=Rafinesquina deltoidea and R. minnesotaensis.

Strophomena demissa Conrad=Stropheodonta demissa.

Strophomena depressa Vanuxem=Leptæna rhomboidalis.

Strophomena depressa ventricosa Hall=Leptæna rhomboidalis ventricosa.

Strophomena (?) doneti Salter. Silurian.

Strophomena doneti Salter, Jour. of a Voyage in Baffins Bay and Barrow Straits, 1852.

Loc. Wellington Channel.

Strophomena elegantula Hall=Plectambonites transversalis.

Strophomena (?) elliptica Conrad. Niagara (Sil.).

Strophomena elliptica Conrad, Third Ann. Rep. Geol. Survey New York, 1839, p. 64.

Loc. Rochester, New York.

Strophomena (?) elongata Conrad. Lower Helderberg (Dev.).

Strophomena elongata Conrad, Jour. Acad. Nat. Sci. Philadelphia, VIII, 1842, p. 259.

Loc. Schoharie, New York.

Strophomena emaciata Winchell and Schuchert. Trenton (Ord.).

Strophomena emaciata W. and S., American Geol., IX, 1892, p. 287;—Minnesota Geol. Survey, III, 1893, p. 399, pl. 31, figs. 22–24.

Loc. Near Cannon Falls, Minnesota.

Strophomena euglyphya Conrad, and Roemer=Strophonella punctulifera.

Strophomena fasciata Hall=Rafinesquina fasciata.

Strophomena filitexta Meek, White, and Hall=S. neglecta or S. incurvata.

Strophomenes flexilis Rafinesque. "Limestone of Ohio."

Same paper as for S. levigata, 1831, p. 4.

Obs. Not defined so as to be recognizable.

Strophomena fluctuosa Billings. Lorraine (Ord.).

Strophomena fluctuosa Billings, Canadian Nat. Geol., V, 1860, p. 57, fig. 6;—Pal. Fossils, I, 1862, p. 123, fig. 102;—Geol. Canada, 1863, p. 209, fig. 207.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 251, pl. 11A, figs. 4, 5.—Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 395, pl. 31, figs. 14–17.

Loc. Charletor Point, Anticosti; Spring Valley, etc., Minnesota.

Strophomena fontinalis White=Dinorthis fontinalis.

Strophomena fragilis Hall=Stropheodonta perplana.

Strophomena galatea Billings=Stropheodonta galatea.

Strophomena gibbosa James=Leptæna rhomboidalis.

Strophomena (?) gibbosa Conrad. Upper Helderberg (Dev.).

Strophomena gibbosa Conrad, Fifth Ann. Rep. Geol. Survey New York, 1841, p. 54.

Loc. Helderberg Mountains, New York.

Strophomena gilpeni Dawson=Stropheodonta gilpeni.

Strophomena halli Sardeson=Leptæna charlottæ.

Strophomena hallie Miller. Utica (Ord.).

Streptorhynchus (?) hallie Miller, Cincinnati Quart. Jour. Sci., I, 1874, p. 148, figs. 14–16.

Streptorhynchus hallanum Miller, North American Geol. and Pal., 1889, p. 378.

Strophomena hallie Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 252.

Loc. Cincinnati, Ohio.

Strophomena hanoverensis Foerste=Strophonella striata.

Strophomena hecuba Billings. Lorraine (Ord.).

Strophomena hecuba Billings, Canadian Nat. Geol., V, 1860, p. 60, fig. 7;—Pal. Fossils, I, 1862, p. 126, fig. 104;—Geol. Canada, 1863, p. 209, fig. 206.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 252.

Loc. Anticosti.

Strophomena hemispherica Hall=Stropheodonta hemispherica.

Strophomena (?) imbecilis Billings. ?Calciferous (Ord.).

Strophomena imbecilis Billings, Pal. Fossils, I, 1865, p. 219.

Loc. Near Portland Creek, Newfoundland.

Strophomena imbrex Billings=Rafinesquina imbrex.

Strophomena impressa Conrad=Stropheodonta varistriata.

Strophomena inæquiradiata Hall=Stropheodonta inæquiradiata.

Strophomena incrassata=Rafinesquina incrassata and R. minnesotaensis.

Strophomena incurvata (Shepard). Trenton (Ord.).

Producta incurvata Shepard, American Jour. Sci., XXXIV, 1838, p. 144, figs. 1, 2.

Orthis incurvata Castelnau, Essai sur le Système Silurien de l'Amérique Septentrionale, 1843, p. 38.

Strophomena convexa Owen, Geol. Expl. Iowa, Wisconsin, and Illinois, 1844, p. 70, pl. XVII, fig. 2.

Leptæna filitexta Hall, Pal. New York, I, 1847, p. 111, pl. 31B, fig. 3.

Strophomena filitexta Billings, Canadian Nat. Geol., I, 1856, p. 203, figs. 1, 2.—Hall, Twelfth Rep. N. Y. State Cab. Nat. Hist., 1859, p. 70.—Billings, Geol. Canada, 1863, p. 164, fig. 142.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 251, pl. 9, figs. 1–7; pl. 9A, figs. 11–14 (non figs. 10, 15=S. neglecta).

Streptorhynchus filitexta Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 39, figs. 1–7; pl. 42, figs. 11–14 (non figs. 10, 15=S. neglecta).

Strophomena incurvata (Shepard)—Continued.

Strophomena incurvata Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 385, pl. 30, figs. 36–40.—Whiteaves, Pal. Foss., III, Pt. III, 1897, p. 167.

Loc. New York; Kentucky; Tennessee; Missouri; Wisconsin; Iowa; Minnesota; Manitoba; Canada.

Strophomena inquassa Sardeson = Rafinesquina minnesotaensis inquassa.

Strophomena interstrialis Hall = Stropheodonta mucronata.

Strophomena interstrialis Vanuxem, and Hall = Stropheodonta interstrialis.

Strophomena irene Billings = Stropheodonta irene.

Strophomena ithacensis Vanuxem = Atrypa reticularis.

Strophomena (?) julia Billings. Anticosti (Sil.).

Strophomena julia Billings, Pal. Fossils, I, 1862, p. 127, fig. 105.

Leptæna julia Shaler, Bull. Mus. Comp. Zool., 4, 1865, p. 65.

Loc. Anticosti.

Strophomena kingi Whitfield = Rafinesquina kingi.

Strophomena lævis Emmons. Birdseye (Ord.).

Strophomena lævis Emmons, Geol. New York; Rep. Second Dist., 1842, p. 385, fig. 972.

Loc. Great Bend, Jefferson County, New York.

Strophomena lachrymosa Conrad = Productella lachrymosa.

Strophomena leda Billings = Stropheodonta leda.

Strophomena lepida Hall = Pholidostrophia iowaensis.

Strophomenes levigata Rafinesque. "Kentucky limestone."

Enumeration and Account of Some Remarkable Natural Objects in the Cabinet of Professor Rafinesque, 1831, p. 4.

Obs. Not defined so as to be recognizable.

Strophomena lima Conrad = Productella lachrymosa lima.

Strophomena lineata Conrad = Chonetes lineatus.

Strophomena macra Winchell and Marcy = Stropheodonta macra.

Strophomena magnifica Billings = Stropheodonta magnifica.

Strophomena magniventra Billings = Stropheodonta magniventer.

Strophomena membranacea Vanuxem = Productella hirsuta.

Strophomena minnesotensis Winchell = Rafinesquina minnesotaensis.

Strophomena (?) minor (Walcott). Pogonip (Ord.).

Streptorhynchus minor Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 75, pl. 11, fig. 9.

Loc. Eureka district, Nevada.

Strophomena (?) modesta Conrad. ? Clinton (Sil.).

Strophomena modesta Conrad, Third Ann. Rep. N. Y. Geol. Survey, 1839, p. 64.

Loc. Rochester, New York.

Obs. Compare with Plectambonites sericea and P. elegantula.

Strophomena mucronata Hall (non Conrad) = Chonetes mucronatus.

Strophomena mucronata Conrad (non Hall) = Stropheodonta mucronata.

Strophomena nacrea Hall = Pholidostrophia iowaensis.

Strophomena (?) nassula Conrad. Carboniferous.

Strophomena nassula Conrad, Proc. Acad. Nat. Sci. Philadelphia, III, 1846, p. 23.

Loc. Jersey Shore, Lycoming County, Pennsylvania.

Strophomena nasuta Conrad=Rafinesquina alternata nasuta.

Strophomena neglecta (James). Lorraine (Ord.).

Strophomena filitexta Meek (non Hall), Pal. Ohio, I, 1873, p. 83, pl. 6, fig. 5.

? Strophomena filitexta White, U. S. Geol. and Geogr. Survey west 100th Merid., IV, 1875, p. 69, pl. 4, fig. 8.

Hemipronites filitextus Miller, Cincinnati Quart. Jour. Sci., II, 1875, p. 43.

Streptorhynchus neglecta James, The Paleontologist, 5, 1881, p. 41.

Streptorhynchus filitextus (partim) Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 42, figs. 10, 15 (non figs. 11–14); pl. 39, figs. 1–7.

Strophomena filitexta Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 9A, figs. 10, 15 (non figs. 11–14); pl. 11A, fig. 3.

Strophomena neglecta Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 388.

Loc. Oxford, Clarksville, Waynesville, etc., Ohio; Richmond, Versailles, etc., Indiana; Savanna, Illinois; ? Silver City, New Mexico.

Strophomena neglecta acuta Winchell and Schuchert. Lorraine (Ord.).

Strophomena neglecta var. acuta W. and S., Minnesota Geol. Survey, III, 1893, p. 388, pl. 31, figs. 6, 7.

Loc. Spring Valley, Minnesota.

Strophomena ? nemea Hall and Whitfield=Dalmanella pogonipensis.

Strophomena nervosa Hall=Stropheodonta perplana nervosa.

Strophomena niagarensis Winchell and Marcy=Stropheodonta profunda.

Strophomena nitens Billings=Rafinesquina nitens.

Strophomena nutans Meek. Lorraine (Ord.).

Strophomena (Hemipronites) nutans (James) Meek, Pal. Ohio, I, 1873, p. 77, pl. 6, fig. 1.

Hemipronites nutans Miller, Cincinnati Quart. Jour. Sci., II, 1875, p. 46.

Streptorhynchus nutans Miller, N. American Geol. Pal., 1889, p. 378.

Strophomena nutans Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 251, pl. 8, fig. 11; pl. 9A, figs. 5–7; pl. 11A, figs. 6, 7.

Loc. Oxford, Clarksville, etc., Ohio; Richmond, Versailles, etc., Indiana.

Strophomena obscura Hall=Rafinesquina obscura.

Strophomena (?) orthididea Hall. Clinton (Sil.).

Leptæna orthididea Hall, Pal. New York, II, 1852, p. 62, pl. 21, fig. 7.

Strophomena orthididea Hall, Twelfth Rep. N. Y. State Cab. Nat. Hist., 1859, p. 82.

Loc. Kirkland, Oneida County, New York.

Strophomena patenta Hall=Strophonella patenta.

Strophomena patersoni Hall=Stropheodonta patersoni.

Strophomena pecten Roemer, and Billings=Orthothetes subplanus.

Strophomena pectinacea Hall=Orthothetes chemungensis.

Strophomena perplana Conrad=Stropheodonta perplana.

Strophomena philomela Billings. Anticosti (Sil.).

Strophomena philomela Billings, Canadian Nat. Geol., V, 1860, p. 56, figs. 4, 5;—Pal. Fossils, I, 1862, p. 122, figs. 100, 101;—Geol. Canada, 1863, p. 311, fig. 317.

Loc. Anticosti.

Strophomena planiconvexa Hall. Lorraine (Ord.).

Leptæna planoconvexa Hall, Pal. New York, I, 1847, p. 114, pl. 31B, fig. 7.

Strophomena planiconvexa Hall—Continued.

Strophomena planoconvexa Hall, Twelfth Rep. N. Y. State Cab. Nat. Hist., 1859, p. 70.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 251, pl. 9, figs. 19, 20.

Strophomena (Hemipronites) planoconvexa Meek, Pal. Ohio, I, 1873, p. 82, pl. 6, fig. 2.

Hemipronites planoconvexa Miller, Cincinnati Quart. Jour. Sci., II, 1875, p. 48.

Streptorhynchus planoconvexus Miller, American Pal. Fossils, 1877, p. 134.—Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 39, figs. 19, 20.

Loc. Cincinnati, Ohio.

Strophomena planidorsata Winchell and Schuchert. Lorraine (Ord.).

Strophomena planodorsata W. and S., American Geol., IX, 1892, p. 286;—Minnesota Geol. Survey, III, 1893, p. 393, pl. 31, figs. 8–10.

Loc. Spring Valley, Minnesota; Iron Ridge, Wisconsin; Wilmington, Illinois.

Strophomena planumbona Hall=S. rugosa.

Strophomena plicata Meek=S. rugosa subtenta.

Strophomena plicifera Hall=Dalmanella plicifera.

Strophomena pleuristriata Conrad=Stropheodonta perplana.

Strophomena profunda Hall=Stropheodonta profunda.

Strophomena punctulifera Vanuxem=Strophonella punctulifera.

Strophomena pustulosa Hall (non Phillips)=Strophalosia truncata.

Strophomena radiata Vanuxem=Strophonella radiata.

Strophomena recta Conrad=Dinorthis deflecta.

Strophomena recta Billings=S. billingsi.

Strophomena rectilateraria Meek and Worthen=Strophonella cavumbona.

Strophomena rectilateris Conrad=Stropheodonta varistriata.

Strophomena (?) reticulata Shaler. Niagara (Sil.).

Strophomena reticulata Shaler, Bull. Mus. Comp. Zool., 4, 1865, p. 62.

Loc. Anticosti.

Strophomena rhomboidalis=Leptæna rhomboidalis.

Strophomena rugosa Hall (non Blainville)=Leptæna rhomboidalis.

Strophomena rugosa (Rafinesque MS.) Blainville. Lorraine (Ord.).

Strophomena rugosa (Rafinesque) Blainville, Malacologie et Conchyliologie, I, 1825, p. 513, pl. 53, figs. 2, 2a.—King, Mon. Permian Fossils, Pal. Soc., 1850, p. 103.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 247, figs. 13, 14.—Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 390, pl. 31, figs. 4, 5.—Whiteaves, Pal. Foss., III, Pt. III, 1897, p. 168.

Strophomenes rugosa Defrance, Dictionaire des Sciences Naturelles, I, 1827, p. 151 and atlas.

Leptæna planumbona Hall, Pal. New York, I, 1847, p. 112, pl. 31, fig. 4.

Leptæna (n. sp.?) Owen, Geol. Survey Wisconsin, Iowa, Minnesota, 1852, pl. 2B, fig. 21. [See specimens in U. S. Nat. Mus., Cat. Invert. Foss., 17876.]

Strophomena planumbona Hall, Geol. Wisconsin, I, 1862, p. 54, fig. 7.—White, Second Ann. Rep. Indiana Bureau Statistics and Geol., 1880, p. 483, pl. 2, figs. 13, 14;—Tenth Rep. Indiana State Geol., 1881, p. 115, pl. 2, figs. 13, 14.—Shaler (partim), Mem. Kentucky Geol. Survey, 1887, p. 13, pls. 4, 5.—Keyes, Geol. Survey Missouri, V, 1895, p. 73.

Strophomena (Hemipronites) planumbona Meek, Pal. Ohio, I, 1873, p. 79, pl. 6, fig. 3.

Strophomena rugosa (Rafinesque MS.) Blainville—Continued.

Streptorhynchus (Strophomena) elongata James, Cincinnati Quart. Jour. Sci., I, 1874, p. 240.

Hemipronites planumbona Miller, Cincinnati Quart. Jour. Sci., II, 1875, p. 45.

Streptorhynchus planumbonus Miller, American Pal. Fossils, 1877, p. 134.

Streptorhynchus elongata Mickelborough and Wetherby, Jour. Cincinnati Soc. Nat. Hist., I, 1878, p. 76.

Streptorhynchus planumbona Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 39, figs. 15–17; pl. 42, figs. 8, 9.

Strophomena planumbona or rugosa Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 251, pl. 9, figs. 15–17; pl. 9A, figs. 8, 9.

Loc. Ohio; Indiana; Kentucky; Missouri; Minnesota and Anticosti. Lower Fort Garry, Manitoba. Probably also at Lattners, Iowa, and Ironridge, Wisconsin.

Strophomena rugosa subtenta (Hall). Lorraine (Ord.).

Strophomena subtenta Conrad, Fifth Ann. Rep. N. Y. Geol. Survey, 1841, p. 37 (undefined).—Billings, Pal. Fossils, I, 1862, p. 132, fig. 109 on p. 130.

Leptæna subtenta Hall, Pal. New York, I, 1847, p. 115, pl. 31B, fig. 9.

Strophomena (Hemipronites) plicata (James) Meek, Pal. Ohio, I, 1873, p. 81, pl. 6, fig. 4.

Hemipronites subtenta Miller, Cincinnati Quart. Jour. Sci., II, 1875, p. 46.

Strophomena rugosa var. subtenta Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 393.—Whiteaves, Pal. Foss., III, Pt. III, 1897, p. 169.

Loc. The same as for S. rugosa.

Strophomena rugosa ventricosa H.=Leptæna rhomboidalis ventricosa.

Strophomena scofieldi Winchell and Schuchert. Trenton (Ord.).

Strophomena scofieldi W. and S., American Geol., IX, April, 1892, p. 286;—Minnesota Geol. Survey, III, 1893, p. 398, pl. 31, figs. 18–21.

Streptorhynchus subsulcatum Sardeson, Bull. Minnesota Acad. Nat. Sci., III, April 9, 1892, p. 335, pl. 4, fig. 39.

Loc. Cannon Falls, Minneapolis, and St. Paul, Minnesota; Beloit, Wisconsin.

Strophomena semifasciata Hall=Strophonella semifasciata.

Strophomena semiovalis Conrad (non Shaler)=Plectambonites sericeus.

Strophomena (?) semiovalis Shaler. Anticosti (Sil.).

Strophomena semiovalis Shaler, Bull. Mus. Comp. Zool., 4, 1865, p. 61.

Loc. Anticosti.

Strophomena septata Winchell and Schuchert. Trenton (Ord.).

Strophomena septata W. and S., American Geol., IX, 1892, p. 285;—Minnesota Geol. Survey, III, 1893, p. 390, pl. 30, figs. 1–3.

Loc. St. Paul, Minneapolis, and Rochester, Minnesota.

Strophomena sericea=Plectambonites sericeus.

Strophomena setigera Hall=Chonetes setigerus.

Strophomena (?) siluriana Davidson. Silurian.

Strophomena siluriana Davidson, British Sil. Brach., Pal. Soc., 1871, p. 303, pl. 47, figs. 1–4.—Etheridge, Quart. Jour. Geol. Soc. London, XXXIV, 1878, p. 597.

Loc. England; Cape Leidy, lat. 79° 38′.

Strophomena sinuata Emmons (non Meek)=S. sulcata.

Strophomena sinuata Meek. Lorraine (Ord.).

Strophomena (Hemipronites) sinuata (James) Meek, Pal. Ohio, I, 1873, p. 87, pl. 5, fig. 5 (non S. sinuata Emmons, 1855).

Hemipronites sinuata Miller, Cincinnati Quart. Jour. Sci., II, 1875, p. 50.

Strophomena sinuata Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 251.

Loc. Cincinnati, *Ohio.*

Strophomena squamula James=Rafinesquina squamula.
Strophomena striata Hall=Strophonella striata.
Strophomena subplana Conrad=Orthothetes subplanus.
Strophomena subtenta Conrad=S. rugosa subtenta.

Strophomena sulcata (Verneuil). Lorraine (Ord.).

Leptæna sulcata Verneuil, Bull. Geol. Soc. France, 2d ser., V, 1848, p. 350.
Strophomena sinuata Emmons, American Geol., I, 1855, p. 199, fig. 61.
Strophomena (Hemipronites?) sulcata Meek, Pal. Ohio, I, 1873, p. 85, pl. 5, fig. 4.
Hemipronites sulcata Miller, Cincinnati Quart. Jour. Sci., II, 1875, p. 48, fig. 5.
Streptorhynchus sulcatus Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 39, figs. 8, 9.
Strophomena sulcata Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 9, figs. 8, 9; pl. 11A, fig. 8.
Loc. Oxford, Clarksville, etc., Ohio; Richmond, Indiana.

Strophomena syrtalis Conrad=Chonetes coronatus.

Strophomena (?) talacastrensis Kayser. Ordovician.

Strophomena talacastrensis Kayser, Palæontographica, Suppl., III, 1876, p. 20, pl. 3, fig. 20.
Loc. Talacastra, Cordillere San Juan, Argentine Republic.

Strophomena tenuilineata Conrad=Rafinesquina tenuilineata.
Strophomena tenuistriata=Leptæna rhomboidalis.
Strophomena textilis Hall=Stropheodonta junia.

Strophomena thalia Billings. Trenton (Ord.).

Strophomena thalia Billings, Canadian Nat. Geol., V, 1860, p. 59;—Pal. Fossils, I, 1862, p. 125, fig. 103;—Geol. Canada, 1863, p. 164, fig. 143.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 251.
Loc. Ottawa, Canada.

Strophomena transversalis Hall=Plectambonites transversalis.

Strophomena trentonensis Winchell and Schuchert. Trenton (Ord.).

Leptæna subtenta (partim) Hall, Pal. New York, I, 1847, p. 115.
Streptorhynchus subtenta Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 39, fig. 18.
Strophomena subtenta Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 251, pl. 9, fig. 18.
Strophomena trentonensis W. and S., Minnesota Geol. Survey, III, 1893, p. 389, pl. 30, fig. 41.
Loc. Cannon Falls, Minneapolis, and Fountain, Minnesota; Janesville and Beloit, Wisconsin; Frankfort, Kentucky; Nashville, Tennessee; Trenton Falls, New York.

Strophomena trilobata (Owen). Trenton (Ord.).

Leptæna trilobata Owen, Geol. Survey Wisconsin, Iowa, Minnesota, 1852, p. 584, pl. 2, figs. 17, 18. [See specimens in U. S. Nat. Mus., Cat. Invert. Foss., 17875.]
Strophomena trilobata Miller, American Pal. Fossils, 1877, p. 138.—Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 395, pl. 31, figs. 12, 13.—Whiteaves, Pal. Foss., III, Pt. III, 1897, pp. 169, 241.
Loc. Turkey River, Iowa; Goodhue County, Minnesota; Lake Winnipeg, Manitoba.

Strophomena tullia Billings=Stropheodonta tullia.
Strophomena ulrichi James=Rafinesquina ulrichi.
Strophomena unicostata Meek and Worthen=Rafinesquina unicostata.

Strophomena undulatus Vanuxem=Leptæna rhomboidalis.
Strophomena undulosa Conrad=Leptæna undulosa.
Strophomena varistriata Conrad=Stropheodonta varistriata.

Strophomena vetusta James. Lorraine (Ord.).

Streptorhynchus (Strophomena) vetusta James, Cincinnati Quart. Jour. Sci., I, 1874, p. 241.

Streptorhynchus vetusta Mickelborough and Wetherby, Jour. Cincinnati Soc. Nat. Hist., I, 1878, p. 76.—James, The Paleontologist, 2, 1878, p. 15.

Loc. Upper part of Cincinnati group in Ohio and Indiana.

Strophomena winchelli Hall and Clarke. Trenton (Ord.).

Streptorhynchus (Strophonella?) deltoidea Hall (non Leptæna deltoidea 1847), Second Ann. Rep. N. Y. State Geol., 1883, pl. 39, figs. 10, 12–14 (non fig. 11=S. nutans).

Strophomena winchelli Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 344, pl. 9, figs. 10, 12–14; pl. 20, fig. 26.—Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 394, pl. 31, fig. 11.

Loc. Janesville, Clifton, and Oshkosh, Wisconsin.

Strophomena wisconsinensis Whitfield. Lorraine (Ord.).

Strophomena wisconsinensis Whitfield, Geol. Wisconsin, IV, 1882, p. 263, pl. 12, figs. 11–13.

Strophomena winconsinensis Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 251, pl. 11A, figs. 1, 2.

Loc. Delafield, Wisconsin.

Strophomena woolworthana Hall=Orthothetes woolworthana.

STROPHONELLA Hall. Genotype Strophomena semifasciata Hall.

Strophonella Hall, Twenty-eighth Rep. N. Y. State Mus. Nat. Hist., 1879, p. 153;—Eleventh Rep. Indiana State Geologist, 1882, p. 291.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 290;—Eleventh Ann. Rep. N. Y. State Geologist, 1894, p. 282.

Strophonella ampla Hall. Upper Helderberg (Dev.).

Strophomena (Strophodonta) ampla Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 111, figs. 1, 2.

Strophomena ampla Billings, Canadian Jour. Sci. Arts, VI, 1861, p. 345, figs. 119, 120;—Geol. Canada, 1863, p. 367, figs. 376, 378.

Strophodonta ampla Hall, Pal. New York, IV, 1867, p. 93, pl. 14, fig. 1.

Strophonella ampla Hall, Twenty-eighth Rep. N. Y. State Mus. Nat. Hist., 1879, p. 154;—Second Ann. Rep. N. Y. State Geol., 1883, pl. 43, figs. 13–15.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 293, pl. 12, figs. 13–15.

Loc. Albany and Schoharie counties, Cherry Valley, Williamsville, etc., New York; Columbus, Ohio; Ontario, Canada.

Obs. Compare with S. schohariensis (Castelnau).

Strophonella cælata Hall. Chemung (Dev.).

Strophodonta cælata Hall, Pal. New York, IV, 1867, p. 112, pl. 19, figs. 6, 7.

Strophonella cælata Hall, Twenty-eighth Rep. N. Y. State Mus. Nat. Hist., 1879, p. 154;—Second Ann. Rep. N. Y. State Geol., 1883, pl. 43, fig. 21.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 293, pl. 12, fig. 21; pl. 15B, fig. 10.

Loc. Near Elmira, New York.

Strophonella cavumbona Hall. Lower Helderberg (Dev.).

Strophodonta cavumbona Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 51;—Pal. New York, III, 1859, p. 187, pl. 21, figs. 1–3.

Strophomena (Strophodonta) cavumbona Meek and Worthen, Geol. Surv. Illinois, III, 1868, p. 374, pl. 7, fig. 10.

Strophonella cavumbona Hall—Continued.

Strophomena rectilateraria Meek and Worthen, Ibidem, 1868, p. 375.

Strophonella cavumbona Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 291, 292.

Loc. Schoharie, Hudson, and Catskill, New York; Perry County, Missouri.

Obs. Probably synonymous with S. punctulifera.

Strophonella costatula Hall and Clarke. Niagara (Sil.).

Strophonella costatula Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, p. 359, pl. 84, figs. 15, 16.

Loc. Louisville, Kentucky.

Strophonella (?) conradi Hall. Lower Helderberg (Dev.).

Strophomena conradi Hall, Pal. New York, III, 1859, p. 194, pl. 16, figs. 13, 14.

Strophonella? conradi Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 292.

Loc. Schoharie, New York.

Strophonella crassa Rowley. Hamilton (Dev.).

Strophonella crassa Rowley, American Geologist, XIII, 1894, p. 153, figs. 4–6.

Loc. Callaway County, Missouri.

Strophonella geniculata (Hall). Lower Helderberg (Dev.).

Strophodonta geniculata Hall, Pal. New York, III, 1859, p. 483, pl. 23, fig. 6.

Loc. Cumberland, Maryland.

Strophonella headleyana Hall. Lower Helderberg (Dev.).

Strophomena (Strophodonta) headleyana Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 49, figs. 1, 2.

Strophodonta headleyana Hall, Pal. New York, III, 1859, p. 185, pl. 20, figs. 1–3.—Meek, American Jour. Sci., 2d ser., XL, 1865, p. 33.

Strophonella headleyana Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 292.

Loc. Schoharie, Hudson, etc., New York; Kennedy Channel and Cape Frazire, Arctic regions.

Strophonella leavenworthana Hall. Lower Helderberg (Dev.).

Strophomena (Strophodonta) leavenworthana Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 53.

Strophodonta leavenworthana Hall, Pal. New York, III, 1859, p. 189, pl. 21, figs. 5-7; pl. 23, figs. 1–3.

Strophonella leavenworthana Hall, Twenty-eighth Rep. N. Y. State Mus. Nat. Hist., 1879, p. 154;—Second Ann. Rep. N. Y. State Geol., 1883, pl. 43, figs. 6–9.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 292, pl. 12, figs. 6–9.

Loc. Albany and Schoharie counties, New York.

Strophonella (?) patenta Hall. Clinton (Sil.).

Leptæna patenta Hall, Pal. New York, II, 1852, p. 60, pl. 21, fig. 3.—Rogers, Geol. Pennsylvania, II, Pt. II, 1858, p. 823, fig. 631.

Strophomena patenta Hall, Twelfth Rep. N. Y. State Cab. Nat. Hist., 1859, p. 82.—Hall and Whitfield, Pal. Ohio, II, 1875, p. 115, pl. 5, fig. 10.—Foerste, Bull. Denison Univ., II, 1887, p. 105, pl. 8, figs. 34–37;—Proc. Boston Soc. Nat. Hist., XXIV, 1890, p. 300, pl. 5, fig. 22.

Streptorhynchus patenta Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 42, figs. 16–18.

Strophomena ? (Strophonella?) patenta Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 291, 292, pl. 9A, figs. 16–18.

Strophomena (Strophonella) patenta Foerste, Geol. Ohio, VII, 1895, p. 569, pl. 27, figs. 35–37.

Loc. Reynales Basin, Medina, etc., New York; Dayton, Ohio; Hanover, Indiana; Collinsville, Alabama.

Strophonella punctulifera (Conrad). Lower Helderberg. (Dev.).

Leptæna punctulifera Conrad, Second Rep. N. Y. Geol. Survey, 1838, pp. 112, 117.

Strophomena euglypha Conrad, Fifth Rep. N. Y. Geol. Survey, 1841, p. 36.—Roemer, Sil. Fauna d. West. Tennessee, 1860, p. 66, pl. 5, fig. 3.—Etheridge, Quart. Jour. Geol. Soc. London, XXXIV, 1878, p. 597.

Strophomena punctulifera Vanuxem, Geol. N. Y.; Rep. Third. Dist., 1842, p. 122, fig. 5.—Rogers, Geol. Pennsylvania, II, Pt. II, 1858, p. 825, fig. 648.—Billings, Proc. Portland Soc. Nat. Hist., 1863, p. 108, pl. 3, fig. 2;—Geol. Canada, 1863, p. 957, fig. 448;—Pal. Fossils, II, 1874, p. 31, pl. 3, fig. 2.

Strophomena (Strophodonta) punctulifera Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 50, fig. 1.

Strophodonta punctulifera Hall, Pal. New York, III, 1859, p. 188, pl. 21, fig. 4; pl. 23, figs. 4–7.—Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 121, pl. 13, fig. 10.

Strophonella punctulifera Hall, Twenty-eighth Rep. N. Y. State Mus. Nat. Hist., 1879, p. 154;—Second. Ann. Rep. N.Y. State Geol., 1883, pl. 43, figs. 10–12.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 292, pl. 12, figs. 10–12.

Loc. Albany and Schoharie counties, New York; Square Lake, Maine; Pennsylvania; Decatur County, Tennessee; Dalhousie, New Brunswick, and Gaspé, Canada; Eureka district, Nevada; Cape Hilgard and Cape Louis Napoleon, Arctic regions.

Obs. See S. cavumbona Hall.

Strophonella (?) radiata (Vanuxem). Lower Helderberg (Dev.).

Strophomena radiata Vanuxem, Geol. N. Y.; Rep. Third Dist., 1842, p. 122, fig. 6.—Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 50, fig. 1;—Pal. New York, III, 1859, p. 193, pl. 21, figs. 8, 9; pl. 18, fig. 3.

Streptorhynchus radiatus Miller, American Pal. Fossils, 1877, p. 134.

Strophonella radiata Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 292.

Loc. Hudson, Albany, and Schoharie counties, New York.

Strophonella reversa Hall. Chemung (Dev.).

Strophodonta reversa Hall, Geol. Survey Iowa, I, Pt. II, 1858, p. 494, pl. 3, fig. 4.

Strophodonta hybrida Hall and Whitfield, Twenty-third Rep. N. Y. State Cab. Nat. Hist., 1873, p. 239.

Strophonella reversa Hall, Twenty-eighth Rep. N. Y. State Mus. Nat. Hist., 1879, p. 154.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 293, pl. 12, figs. 16–20.

Strophonella? (Strophodonta) reversa Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 43, figs. 16–20.

Loc. Rockford, Iowa; Naples, New York.

Strophonella schohariensis (Castelnau). ? Upper Helderberg (Dev.).

Orthis schohariensis Castelnau Essai Syst. Sil. l'Amérique Septentrionale, 1843, p. 36, pl. 14, fig. 5.

Loc. Schoharie, New York.

Obs. Compare with S. ampla.

Strophonella semifasciata Hall. Niagara (Sil.).

Strophomena (Strophodonta?) semifasciata Hall, Trans. Albany Inst., IV, 1863, p. 210.

Strophonella semifasciata Hall, Twenty-eighth Rep. N. Y. State Mus. Nat. Hist., 1879, p. 154, pl. 22, figs. 1–3; pl. 23, figs. 7, 8;—Eleventh Rep. Indiana State Geol., 1882, p. 292, pl. 22, figs. 1–3; pl. 23, figs. 7, 8;—Second Ann. Rep. N. Y. State Geol., 1883, pl. 43, figs. 4, 5.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 12, figs. 4, 5.

Loc. Waldron, Indiana; Wisconsin.

Strophonella striata Hall. Niagara (Sil.).

Strophomena striata Hall, Geol. N. Y.; Rep. Fourth Dist., 1843, p. 104, fig. 3;—Twelfth Rep. N. Y. State Cab. Nat. Hist., 1859, p. 82.

Strophodonta striata Hall, Twenty-eighth Rep., Ibidem, 1879, p. 152, pl. 23, figs. 1–6;—Eleventh Rep. Indiana State Geol., 1882, p. 290, pl. 23, figs. 1–6.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 149.

Leptæna striata Hall, Pal. New York, II, 1852, p. 259, pl. 53, fig. 7.

Strophodonta (Strophonella?) striata Hall, Second Ann. Rep. N. Y. State Geol., 1883, pl. 43, figs. 1–3.

Strophonella striata Beecher and Clarke, Mem. N. Y. State Mus., I, 1889, p. 25, pl. 3, figs. 1–8.

Strophomena hanoverensis Foerste, Proc. Boston Soc. Nat. Hist., XXIV, 1890, p. 301, pl. 6, fig. 1.

Strophonella (Amphistrophia) striata Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 292, pl. 12, figs. 1–3.

Strophomena (Orthothetes) hanoverensis Foerste, Geol. Ohio, VII, 1895, p. 567, pl. 27, fig. 34; pl. 31, fig. 1.

Loc. Lockport, New York; Waldron and Hanover, Indiana; Louisville, Kentucky.

Syntrielasma Meek and Worthen=Enteletes.

SYNTROPHIA Hall and Clarke. Genotype Triplesia lateralis Whitfield.

Syntrophia Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 270;—Ibidem, Pt. II, 1893, p. 216;—Thirteenth Ann. Rep. N. Y. State Geologist, 1895, p. 836.

Syntrophia arachne (Billings). Upper Cambrian.

Stricklandia? arachne Billings, Pal. Fossils, I, 1862, p. 85, fig. 77.

Syntrophia arachne Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 216.

Loc. Point Levis, Canada.

Syntrophia arethusa (Billings). Upper Cambrian.

Stricklandinia? arethusa Billings, Pal. Fossils, I, 1862, p. 85, fig. 78.

Syntrophia arethusa Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 216.

Loc. Point Levis, Canada.

Syntrophia (?) armanda (Billings). Upper Cambrian.

Orthis? armanda Billings, Pal. Fossils, I, 1865, p. 303, fig. 293.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 217.

Loc. Phillipsburg, Canada.

Obs. This species may prove to be a Billingsella. In the interior of the ventral valve "the dental plates seem to form an imperfect triangular chamber" (Billings). If there is present a true spondylium and the foramen is "apparently open" O. armanda will prove to be more nearly related to Syntrophia than to any other genus. If, however, there is present only an imperfect triangular chamber and the foramen closed by a deltidium, then the species is probably a Billingsella.

Syntrophia barabuensis (A. Winchell). Upper Cambrian.

Orthis barabuensis A. Winchell, American Jour. Sci., 2d ser., XXXVII, 1864, p. 228.

Leptæna barabuensis Whitfield, Ann. Rep. Geol. Survey Wisconsin, 1877, p. 60;—Geol. Wisconsin, IV, 1882, pp. 171, 195, pl. 1, figs. 6, 7; pl. 3, fig. 6.

Syntrophia barabuensis Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 216.

Loc. Near Baraboo, Wisconsin.

Syntrophia calcifera (Billings). Upper Cambrian.

Camarella calcifera Billings, Canadian Nat. Geol., VI, 1861, p. 318, fig. 3;—Geol. Canada, 1863, p. 231, fig. 247;—Pal. Fossils, I, 1865, p. 220.—Meek, Sixth Ann. Rep. U. S. Geol. Survey Terr., 1873, p. 464.

Syntrophia calcifera (Billings)—Continued.

Triplesia calcifera Walcott, Mon. U. S. Geol. Survey, VIII, 1884, p. 75, pl. 11, figs. 7, 8.

Triplecia? calcifera Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 270.

Syntrophia (?) calcifera Hall and Clarke, Ibidem, VIII, Pt. II, 1893, p. 218, pl. 62, fig. 24.

Loc. Point Levis and Phillipsburg, Canada; Cow Head, Newfoundland; near Malade City, Utah; Eureka district, Nevada; Carter County, Missouri (Keyes).

Syntrophia lateralis (Whitfield). Calciferous (Ord.).

Triplesia lateralis Whitfield, Bull. American Mus. Nat. Hist., 1886, p. 303, pl. 24, figs. 9–11.

Syntrophia lateralis Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 270;—Ibidem, VIII, Pt. II, 1893, p. 216, pl. 62, figs. 1–10.

Loc. Fort Cassin, Vermont.

Syntrophia primordialis (Whitfield). Upper Cambrian.

Triplesia primordialis Whitfield, Ann. Rep. Geol. Survey Wisconsin, 1877, p. 51;—Geol. Wisconsin, IV, 1882, p. 172, pl. 10, figs. 1, 2.

Triplecia primordialis Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 271.

Syntrophia primordialis Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 218.

Loc. Adams County, Wisconsin.

SYRINGOTHYRIS A. Winchell. Genotype Spirifer carteri Hall.

Syringothyris A. Winchell, Proc. Acad. Nat. Sci. Philadelphia, 1863, p. 6.—Meek, Ibidem, 1865, p. 275;—Pal. Ohio, II, 1875, p. 288.—White, Wheeler's Expl. Survey west 100th Merid., IV, 1875, p. 90.—Herrick, Bull. Denison Univ., IV, 1888, p. 14.—Schuchert, Ninth Ann. Rep. N. Y. State Geol., 1890, p. 28.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 47;—Thirteenth Ann. Rep. N. Y. State Geologist, 1895, p. 760.

Syringothyris alta Schuchert=Cyrtia alta.

Syringothyris angulata Simpson. Waverly (L. Carb.).

Syringothyris angulata Simpson, Trans. American Phil. Soc., n. ser., XVI, 1889, p. 440, fig. 5.—Schuchert, Ninth Ann. Rep. N. Y. State Geol., 1890, p. 32.

Loc. Warren, Pennsylvania.

Syringothyris carteri (Hall). Waverly and Burlington (L. Carb.).

Spirifer carteri Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 170.—Meek (partim), Pal. Ohio, II, 1875, p. 285 (not his figures=S. texta Hall).

Spirifer (Crytia?) hannibalensis Swallow, Trans. St. Louis Acad. Sci., I, 1860, p. 647.

Syringothyris typa Winchell, Proc. Acad. Nat. Sci. Philadelphia, 1863, p. 7;—Proc. Am. Phil. Soc., XII, 1870, p. 252.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pp. 8, 48, 50, pl. 26, figs. 6, 7, 10; pl. 27, figs. 1–3.

Spirifer cuspidatus Meek, Proc. Acad. Nat. Sci., Philadelphia, 1865, p. 275;—Am. Jour. Sci., 2d ser., XLIII, 1867, p. 407.

Spirifer cuspidatus ? Meek, U. S. Geol. Expl., 40th Parl., IV, 1877, p. 87.

Syringothyris cuspidatus Walcott (non Martin), Mon. U. S. Geol. Survey, VIII, 1884, p. 219, pl. 3, fig. 11.—Herrick (partim), Bull. Denison Univ., III, 1888, p. 41, pl. 1, fig. 7; pl. 2, fig. 17 (non pl. 5, figs. 4–7=S. herricki).

Syringothyris carteri Schuchert, Ninth Ann. Rep. N. Y. State Geol., 1890, p. 30.—Keyes, Geol. Survey Missouri, V, 1895, p. 87, pl. 40, fig. 10.

Syringothyris typa Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 48, fig. 40.

Syringothyris hannibalensis Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 25, figs. 33–35.

Loc. Licking County and Bedford, Ohio; Burlington, Iowa; Marion and Pike, counties, Missouri; White Pine and Eureka districts, Nevada; near Clendenin, Montana.

Syringothyris cuspidatus Walcott, and Herrick=S. carteri.

Syringothyris extenuata (Hall). Waverly (L. Carb.).

Spirifer extenuatus Hall, Geol. Survey Iowa, I, Pt. II, 1858, p. 520, pl. 7, fig. 6.—White, Wheeler's Expl. and Surv. west 100th Merid., 1875, p. 88, pl. 5, fig. 9.

Syringothyris halli A. Winchell, Proc. Acad. Nat. Sci. Philadelphia, 1863, p. 8.

Syringothyris extenuata Schuchert, Ninth Ann. Rep. N. Y. State Geol., 1890, p. 33.—Keyes, Geol. Survey Missouri, V, 1895, p. 86.

Loc. Burlington, Iowa; Clarksville, Missouri; Battlecreek, Michigan; Mountain Spring, Nevada.

Syringothyris gigas (Troost). Subcarboniferous.

Cyrtia gigas Troost, Sixth Geol. Report Tennessee, 1841, p. 12.

Syringothyris gigas Schuchert, Ninth Ann. Rep. N. Y. State Geol., 1890, p. 33.

Loc. Harpeth River, Tennessee.

Syringothyris halli Winchell=S. carteri extenuata.

Syringothyris herricki Schuchert. Waverly (L. Carb.).

Syringothyris cuspidatus Herrick (partim), Bull. Denison Univ., III, 1888, pl. 5, figs. 4–7 (not pls. 1, 2).

Syringothyris herricki Schuchert, Ninth Ann. Rep. N. Y. State Geologist, 1890, p. 36.—Herrick, Geol. Ohio, VII, 1895, pl. 21, figs. 4–7.

Loc. Granville, Ohio.

Syringothyris missouri Hall and Clarke. Chouteau (L. Carb.).

Syringothyris missouri Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, p. 363, pl. 39, figs. 29–31.

Loc. Chouteau Springs, Missouri.

Syringothyris (?) plena (Hall). Burlington (L. Carb.).

Spirifer plena Hall, Geol. Survey Iowa, I, 1858, p. 603, pl. 13, fig. 4.

Syringothyris? plena Schuchert, Ninth Ann. Rep. N. Y. State Geologist, 1890, p. 37.

Spirifer plenus Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pp. 31, 39, 48, pl. 37, figs. 32, 33.

Syringothyris plena Keyes, Geol. Survey Missouri, V, 1895, p. 88, pl. 40, fig. 8.

Loc. Burlington, Iowa; Hannibal, Missouri; Quincy, Illinois.

Syringothyris randalli. Simpson. Waverly (L. Carb.).

Syringothyris randalli Simpson, Trans. American Phil. Soc., n. ser., XVI, 1889, p. 441, fig. 6.—Schuchert, Ninth Ann. Rep. N. Y. State Geologist, 1890, p. 36.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 50, pl. 27, figs. 13–16.

Loc. Near Warren and Union City, Pennsylvania.

Syringothyris texta (Hall). Waverly to Keokuk (L. Carb.).

Spirifer cuspidatus Yandell and Shumard, Cont. Geol. Kentucky, 1847, pp. 19, 21.

Spirifer textus Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 169.—White, Second Ann. Rep. Indiana Bureau Statistics and Geol., 1880, p. 512, pl. 7, figs. 1, 2;—Tenth Rep. Indiana State Geol., 1881, p. 144, pl. 7, figs. 1, 2.

Spirifer subcuspidatus Hall, Geol. Survey Iowa, I, 1858, p. 646, pl. 20, fig. 5;—Pal. New York, IV, 1867, p. 249.

Spirifer propinquus Hall, Geol. Survey Iowa, I, 1858, p. 647.—Meek and Worthen, Geol. Survey Illinois, 1868, III, p. 530, pl. 19, fig. 8.

Spirifer carteri Meek (partim), Pal. Ohio, II, 1875, pl. 14, fig. 7.

Spirifer cuspidatiformis Miller, North American Geol. Pal., 1889, p. 372.

Syringothyris texta Schuchert, Ninth Ann. Rep. N. Y. State Geol., 1890, p. 34.—Keyes, Geol. Survey Missouri, V, 1895, p. 88.

Syringothyris subcuspidatus and texta Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 50, pl. 26, figs. 8, 11 (?9, 12); pl. 27, figs. 4–12, 18.

Loc. New Albany and New Providence, Indiana; near Louisville, Kentucky; *Sciotoville*, Ohio; Keokuk, Iowa; Warsaw and Nauvoo, Illinois.

Syringothyris typa Winchell=S. carteri.

TEREBRATELLA d'Orbigny.

Genotype Terebratula chilensis Brod.=Terebratula dorsata Gmelin.

Terebratella d'Orbigny, Pal. Franc. Ter. Cret., IV, 1847, p. 110.—Dall, American Jour. Conch., VI, 1870, p. 115.—Beecher, Trans. Connecticut Acad., IX, 1893, p. 377.

Terebratella californica Stanton. Upper Cretaceous (Knoxville).

Terebratella californica Stanton, Bull. U. S. Geol. Survey, 133, 1896, p. 33, pl. 1, figs. 12, 13.

Loc. Cottonwood Creek, Tehama County, California.

Terebratella (?) dubitanda (Cooper). ?Upper Cretaceous.

Megerlia dubitanda Cooper, Bull. California State Mining Bureau, 4, 1894, p. 50, pl. 3, figs. 48, 49.

Loc. Lajolla and Point Loma, California.

Terebratella (?) imbricata (Cooper). ?Upper Cretaceous.

Megerlia imbricata Cooper, Bull. California State Mining Bureau, 4, 1894, p. 51, pl. 3, figs. 50, 51.

Loc. Lajolla, California.

Terebratella obesa Gabb. Cretaceous (Chico).

Terebratella obesa Gabb, Geol. Survey California, Pal., I, 1864, p. 205, pl. 26, fig. 194.

?Terebratella obesa Whiteaves, Mesozoic Fossils, Geol. Survey Canada, I, 1884, p. 245.

Loc. Texas Flat, Placer County, California; Queen Charlotte Island.

Terebratella plicata (Say). Cretaceous.

Terebratula plicata Say, American Jour. Sci., II, 1820, p. 43;—Jour. Acad. Nat. Sci. Philadelphia, VI, 1829, p. 73, pl. 3, figs. 5, 6.

Terebratula sayi Morton, Syn. Cret. United States, 1834, p. 71, pl. 3, figs. 3, 4;—American Jour. Sci., XLVIII, 1845, p. 283.

Terebratella plicata d'Orbigny, Prod. Pal., 1849, p. 259.—Gabb, Proc. American Phil. Soc., VIII, 1861, p. 193.—Credner, Zeitscr. d. Deuschen Geol. Gessel., 1870, p. 224.—Whitfield, Mon. U. S. Geol. Survey, IX, 1885, p. 12, pl. 1, figs. 5-9.

Loc. New Jersey.

Terebratella vanuxemi (Lyell and Forbes). Cretaceous.

Terebratula vanuxemiana Lyell and Forbes, Proc. Geol. Soc. London, 1844, p. 308, with figures.

Terebratula vanuxemi Lyell and Forbes, Quart. Jour. Geol. Soc. London, I, 1845, p. 62, with figures.

Terebratella vanuxemiana d'Orbigny, Prod. Pal., 1849, p. 259.—Gabb, Proc. Acad. Nat. Sci. Philadelphia, 1861, p. 19;—Proc. American Phil. Soc., VIII, 1861, p. 194.—Whitfield, Mon. U. S. Geol. Survey, IX, 1885, p. 14, pl. 1, figs. 1-4.

Terebratella vanuxemi Hollick, Trans. N. Y. Acad. Sci., XI, 1892, p. 98, pl. 1, fig. 6.

Loc. New Jersey; Tottenville, Staten Island.

Terebratella whitneyi Gabb=Rhynchonella whitneyi.

TEREBRATULA Llhwyd. Genotype T. perovalis Sowerby.

Terebratula Llhwyd, Lithophylacii Britannici Ichnographia, 1696.—Hall, Pal. New York, IV, 1867, p. 386.—Dall, American Jour. Conch., VI, 1870, p. 101.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 153.

Terebratula ænigma d'Orbigny=Rhynchonella ænigma.

Terebratula ænigma Darwin=Rhynchonella anduin.

Terebratula acuminatissima Castelnau=Spirifer acuminatus.

Terebratula andii d'Orbigny=Enteletes andii.

Terebratula antissiensis d'Orbigny=Rhynchonella antissiensis.

Terebratula atlantica Morton=Terebratulina atlantica.

Terebratula arcuata Swallow (non Roemer)=Dielasma shumardanum.

Terebratula augusta Hall and Whitfield. Triassic-Jurassic.

Terebratula augusta Hall and Whitfield, King's U. S. Geol. Expl. 40th Parl., IV, 1877, p. 285, pl. 7, figs. 7-10.—White, Bull. U. S. Geol. Survey Terr., IV, 1880, p. 108;—Twelfth Ann. Rep. U. S. Geol. Survey Terr., 1883, p. 109.

Loc. Shoshone Springs, Nevada; Triassic, southwestern Idaho.

Terebratula bicanaliculata Schlotheim. Jurassic.

Terebratula bicanaliculata Schl., Mém. Soc. Géol. France, 2d ser, IV, 1851, p. 31, pl. 8, figs. 17-19.

Terebratula cornuta Burmeister and Geibel, Abh. Naturf. Gessel. Halle, VI, 1862, p. 127.

Loc. Europe; Dona Ana, Chile.

Terebratula bisacula McChesney. Kaskaskia (L. Carb.).

Terebratula bisacula McChesney, Descriptions New Fossils, 1861, p. 82.

Loc. Chester and Golconda, Illinois.

Terebratula borealis Castelnau=Clitambonites borealis.

Terebratula bovidens Morton=Dielasma bovidens.

Terebratula brevilobata Swallow. Warsaw (L. Carb.).

Terebratula brevilobata Swallow, Trans. St. Louis Acad. Sci., II, 1863, p. 84.

Loc. Ste. Genevieve County, Missouri.

Terebratula burlingtonensis White=Dielasma burlingtonensis.

Terebratula camila Morton=T. harlani.

Terebratula canipes Ravenel. Jackson (Eocene).

Terebratula canipes Ravenel, Proc. Acad. Nat. Sci. Philadelphia, II, 1844, p. 97.—Conrad, American Jour. Conch., I, 1865, p. 15.

Loc. South Carolina.

Terebratula carneoidea Guppy. Eocene.

Terebratula carneoidea Guppy, Quart. Jour. Geol. Soc. London, XXII, 1866, p. 296, pl. 19, fig. 2.

Loc. San Fernando, Trinidad.

Obs. May be the same as living Terebratula cubensis Pourtales (Dall)=Liothyris sphenoidea (Philippi). The latter also occurs fossil in the Pliocene of Calabria and Sicily (Davidson).

Terebratula chiliensis d'Orbigny. Quarternary.

Terebratula chilensis d'Orbigny, Voyage dans l'Amérique Mérid., Pal., 1842, p. 163.

Loc. Coquimbo, Chile.

Terebratula choctawensis Shumard=Kingina wacoensis.

Terebratula concinna Bayle and Coquand=Rhynchonella ænigma.

Terebratula cooperensis Miller=Seminula parva.

Terebratula copiapensis Möricke. Jurassic.

Terebratula copiapensis Möricke, Neues Jahrb. f. Mineral., Beilageband, IX, 1894, p. 63, pl. 2, figs. 5a-5c.

Loc. Quebrada de Maricunga, Chile.

Terebratula demissirostris Conrad. Eocene.

Terebratula demissirostra Conrad, Kerr's Geol. North Carolina, App. A, 1875, p. 18, pl. 3, fig. 1.

Loc. Wilmington, North Carolina.

Terebratula derbyana Rathbun. Middle Devonian.

Terebratula derbyana (Hartt MS.) Rathbun, Bull. Buffalo Soc. Nat. Hist., I, 1874, p. 236, pl. 10, figs. 15, 17, 22, 24, 25.—Rathbun, Proc. Boston Soc. Nat. Hist., XX, 1879, p. 35.

Loc. Erere, Province of Para, Brazil.

Terebratula domeykana Bayle and Coquand. Jurassic.

Terebratula domeykana Bayle and Coquand, Mém. Soc. Géol. France, 2d ser., IV, 1851, p. 30, pl. 8, figs. 1–3.—Burmeister and Geibel, Abh. Naturf. Gessel. Halle, VI, 1862, p. 126.—Möricke, Neues Jahrb. f. Mineral., Beilageband, IX, 1894, p. 64.

Loc. Sierra de la Ternera, Dona Ana, and Juntas, Chile.

Terebratula dorenbergi Felix. Upper Jurassic.

Terebratula dorenbergi Felix, Palæontographica; XXXVII, 1891, p. 176, pl. 27, figs. 8–8b.

Loc. Cerro de Titania, Oaxaco, Mexico.

Terebratula elia Hall. Middle Devonian.

Terebratula elia Hall, Pal. New York, IV, 1867, p. 390, pl. 60, figs. 26–28.

Loc. Waterloo, Iowa.

Terebratula elongata of American authors=Dielasma bovidens.

Terebratula emarginata Sowerby. Jurassic.

Terebratula emarginata (Sowerby) Bayle and Coquand, Mém. Soc. Géol. France, 2d ser., IV, 1851, p. 32, pl. 8, figs. 7–9.

Loc Europe; Dona Ana, Chile.

Terebratula ficoides Bayle and Coquand. Jurassic.

Terebratula ficoides Bayle and Coquand, Mém. Soc. Géol. France, 2d ser., IV, 1851, p. 30, pl. 8, figs. 20–22.

Loc. Dona Ana, Chile.

Terebratula floridana Morton=Terebratulina floridana.

Terebratula formosa Hall=Dielasma formosum.

Terebratula fragilis Morton=Terebratula harlani.

Terebratula gaudryi d'Orbigny=Enteletes gaudryi.

Terebratula geniculosa McChesney=Dielasma bovidens.

Terebratula glossa Conrad=Terebratulina atlantica.

Terebratula gorbyi Miller=Dielasma gorbyi.

Terebratula gottschei Steinman. Jurassic.

Terebratula gottschii Steinman, Neues Jahrb. f. Min., Beilageband, 1881, p. 252, pl. 14, figs. 7, 8.

Loc. Caracoles, Bolivia.

Terebratula gracilis Swallow (non Von Buch)=T. swallovana.

Terebratula guadalupæ Roemer=Terebratulina guadalupæ.

Terebratula halliana Gabb=Terebratulina atlantica.

Terebratula harlani Morton. Upper Cretaceous.

Terebratula harlani Morton, American Jour. Sci., XVIII, 1829, p. 250, pl. 3, fig. 16;—Ibidem, XVII, 1829, p. 283;—Jour. Acad. Nat. Sci. Philadelphia, VI, 1829, p. 73, pl. 3, figs. 1–4, 7, 8;—Syn. Cret. U. S., 1834, p. 70, pl. 3, fig. 1; pl. 9,

Terebratula harlani Morton—Continued.

figs. 2, 8, 9.—Gabb, Proc. Acad. Nat. Sci. Philadelphia, 1861, p. 18;—Proc. American Phil. Soc., VIII, 1861, p. 196.—Credner, Zeit. d. Deutschen Geol. Gessel, 1870, p. 221.—Whitfield, Mon. U. S. Geol. Survey, IX, 1885, p. 6, pl. 1, figs. 15–23.

Terebratula fragilis Morton (non Schloth.), Jour. Acad. Nat. Sci. Philadelphia, VI, 1829, p. 75, pl. 3, figs. 3, 4;—American Jour. Sci., XVIII, 1829, p. 250, pl. 3, fig. 17;—Ibidem, XVII, p. 283;—Syn. Cret. U. S., 1834, p. 70, pl. 3, fig. 2.

Terebratula perovalis Morton (non Sowerby), Jour. Acad. Nat. Sci. Philadelphia, VI, 1829, p. 77, pl. 3, figs. 7, 8.

Terebratula camilla Morton, Syn. Cret. U. S., 1834, p. 70, in text.

Terebratula harlani var. discoidea Morton, Syn. Cret. U. S., 1833.

Terebratula harlani var. rectilatera Morton, Ibidem.

Terebratula subfragilis d'Orbigny, Prod. Pal., II, 1849, p. 258.

Terebratula atlantica (non Morton) Gabb, Proc. Acad. Nat. Sci. Philadelphia, 1861, p. 18.

Loc. New Jersey; Delaware and South Carolina.

Terebratula harmonia Hall=Eunella harmonia.

Terebratula hastata of American authors=Dielasma bovidens.

Terebratula helena Whitfield. Upper Cretaceous.

Terebratula helena Whitfield, Ludlow's Rep. Black Hills Dakota, 1875, p. 103, figs. 5–10.

Loc. North of Belle Fourche, South Dakota.

Terebratula hochstetteri Toula=Dielasma hochstetteri.

Terebratula hohmanni Möricke. Jurassic.

Terebratula hohmanni Möricke, Neues Jahr. f. Mineral., Beilageband, IX, 1894, p. 64, pl. 6, figs. 4a, 4b.

Loc. Quebrada de Maricunga, Chile.

Terebratula humboldtensis Gabb. Triassic.

Terebratula humboldtensis Gabb, Geol. Survey California, Pal., I, 1864, p. 34, pl. 6, fig. 35.—Hall and Whitfield, King's U. S. Geol. Expl. 40th Parl., IV, 1877, p. 282, pl. 6, figs. 22–24.—Whiteaves, Cont. Canadian Pal., I, 1889, p. 129.

Loc. Star Canyon, Humboldt County, and Dun Glen Pass, Pah-Ute Range, Nevada; Nicola Lake, Canada.

Terebratula ignaciana d'Orbigny. Jurassic.

Terebratula ignaciana d'Orbigny, Voyage dans l'Amérique Mérid., Pal., 1842, p. 63, pl. 22, figs. 14, 15.—Darwin, Geological Observations on South America, 1846, p. 216.

Loc. Cordillere du Chili, South America.

Terebratula inca Forbes=T. perovalis.

Terebratula inconstans Herrick=Cryptonella inconstans.

Terebratula inornata McChesney. "Keokuk to Coal Measures."

Terebratula inornata McChesney, New Pal. Fossils, 1860, p. 48.

Loc. Sangamon County, Illinois.

Terebratula itaitubensis Derby=Dielasma itaitubense.

Terebratula jucunda Hall. Middle Devonian.

Terebratula jucunda Hall, Pal. New York, IV, 1867, p. 390, pl. 60, figs. 29–31.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 154.

Loc. Waterloo, Iowa; Jefferson and Clark counties, Indiana.

Terebratula lachryma Morton=Terebratulina lachryma.

Terebratula lacunosa Schl. Jurassic.

Terebratula lacunosa (Schl.) Bayle and Coquand, Mém. Soc. Géol. France, ser. ii, IV, 1851, p. 29, pl. 3, figs. 10, 11.

Loc. Europe; Dona Ana, Chile.

Terebratula lapillus Morton. Coal Measures.

Terebratula lapillus Morton, American Jour. Sci., XXIX, 1836, p. 153, pl. 26, fig. 36.

Loc. Junior Furnace, Scioto County, Ohio.

Obs. Not determinable.

Terebratula lecta Guppy. Eocene.

Terebratula lecta Guppy, Quart. Jour. Geol. Soc. London, XXII, 1866, p. 296, pl. 19, fig. 3.

Loc. San Fernando, Trinidad.

Terebratula lens Hall=Cryptonella lens.

Terebratula leonensis Conrad=Kingena leonensis.

Terebratula liardensis Whiteaves. Triassic.

Terebratula liardensis Whiteaves, Cont. Canadian Pal., I, 1889, p. 130, pl. 17, fig. 2. (Abstract of same pub. 1888.)

Loc. Liard River, Canada.

Terebratula lincklæni Hall=Eunella lincklæni.

Terebratula marcyi Shumard=Eumetria marcyi.

Terebratula meridionalis Conrad. Oolite or Cretaceous.

Terebratula meridionalis Conrad, U. S. Astronomical Exped. to the Southern Hemisphere, 1855, p. 282, pl. 42, fig. 10.

Loc. Cordillera de Dona Ana, Chile.

Terebratula mesogona Castelnau. Formation.?

Terebratula mesogona Castelnau (non Phillips), Essai Syst. Sil. l'Amérique Septentrionale, 1843, p. 40, pl. 13, fig. 3.

Loc. Vicinity of Quebec, Canada.

Obs. Undeterminable.

Terebratula mexicana Hall. ?Upper Carboniferous.

Terebratula mexicana Hall, Emory's Rep. U. S. and Mexican Bound. Survey, I, 1857, pl. 20, fig. 2.

Loc. Not given.

Obs. Undefined. Compare with Seminula argentea.

Terebratula millipunctata Hall=Dielasma bovidens.

Terebratula mormoni Marcou=Hustedia mormoni.

Terebratula navicella Hall=Centronella navicella.

Terebratula nitens Conrad. Miocene.

Terebratula nitens Dana, Wilkes's U. S. Exped., X, 1849, p. 726, pl. 19, fig. 1. (Conrad's earlier description I have not found.)

Rhynchonella nitans Conrad, American Jour. Conch., 1865, p. 154.

Terebratula nuciformis Morton. Coal Measures.

Terebratula nuciformis Morton, American Jour. Sci., XXIX, 1836, p. 150, pl. 2, fig. 5.

Loc. Putnam Hill east of Flint Ridge, Ohio.

Obs. Not defined so as to be recognizable.

Terebratula nucula Sowerby=Rhynchonella nucula.

Terebratula occidentalis Miller=Dielasma occidentale.

Terebratula ovoides Eaton=Rensselæria ovoides.

Terebratula ontario Hall. Hamilton (Dev.).

Terebratula ontario Hall, Pal. New York, IV, 1867, p. 418, pl. 60, figs. 45–48.

Loc. Canandaigua Lake, New York.

Terebratula ornithocephala Bayle and Coquand=T. subovoides.

Terebratula parva Swallow=Seminula parva.

Terebratula patagonica Sowerby. Tertiary.

Terebratula patagonica Sowerby, Darwin's Geol. Observations on South America, 1846, p. 252, pl. 2, fig. 25.

Loc. St. Josef and St. Julian, Patagonia.

Terebratula pennata Atwater=Spirifer pennatus.

Terebratula (Zeilleria) perforata Piette. Jurassic.

Terebratula (Zeilleria) perforata (Piette) Möricke, Neues Jahrb. f. Mineral., Beilageband, IX, 1894, p. 65.

Loc. Europe; Sierre de la Ternera, Chile.

Terebratula perinflata Shumard. Upper Carboniferous.

Terebratula perinflata Shumard, Trans. St. Louis Acad. Sci., I, 1859, p. 392.

Loc. Guadalupe Mountains, Texas.

Terebratula perovalis Eaton (non Sowerby)=Rensselæria ovoides.

Terebratula perovalis Morton (non Sowerby)=T. harlani.

Terebratula perovalis Sowerby. Jurassic.

Terebratula inca Forbes, Darwin's Geol. Observations S. America, 1846, p. 268, pl. 5, figs. 19–20.

Terebratula perovalis Bayle and Coquand, Mém. Soc. Géol. France, ser. ii, IV, 1851, p. 22, pl. 8, figs. 15, 16.—Gottsche, Palæontographica, Suppl., III, 1878, p. 33, pl. 4, fig. 9.—Steinman, Neues Jahrb. f. Min., Beilageband, I, 1881, p. 252.—Möricke, Ibidem, Beilageband, IX, 1894, p. 65, pl. 3, figs. 6a–6c.

Loc. Europe; Manflas, Tres Cruces, Iquique, and Espinazito, Chile; Caracoles, Bolivia.

Terebratula peruviana d'Orbigny=Seminula argentea.

Terebratula planirostra Hall=Cryptonella planirostris.

Terebratula planosulcata Meek and Worthen=Cleiothyris roissyi.

Terebratula plicata Say=Terebratella plicata.

Terebratula poeyana Lea. ?Jurassic.

Terebratula poeyana Lea, Trans. American Phil. Soc., n. ser., VII, 1841, p. 260, pl. 10, fig. 13.

Loc. Habana, Cuba.

Terebratula prisca=Atrypa reticularis.

Terebratula punctata Sowerby. Liassic.

Terebratula punctata Sowerby, Mineral Conch., I, 1812, p. 46, tab. 15, fig. 4.—Davidson, British Oolitic and Liassic Brach., Pal. Soc., 1852, p. 45.—Burmeister and Geibel, Abh. Naturf. Gessel. Halle, VI, 1862, p. 127.

Terebratula cfr. punctata Behrendsen, Zeit. der. Deutschen Geol. Gessel., XLIII, 1891, p. 395.

Terebratula (Waldheimia) punctata (Sowerby) Möricke, Neues Jahrb. f. Mineral., Beilageband, IX, 1894, p. 66.

Loc. Europe; Portezuelo Ancho, Argentine Republic; Manflas, Juntas, Chile.

Terebratula raimondiana Gabb. ?Cretaceous.

Terebratula raimondiana Gabb, Jour. Acad. Nat. Sci. Philadelphia, 2d ser., VIII, 1881, p. 298, pl. 42, fig. 9.

Loc. Near Ollon, Peru.

Terebratula reticularis=Atrypa reticularis.
Terebratula rectirostra Hall=Cryptonella rectirostris.

Terebratula repellini d'Orbigny. Jurassic.
Terebratula repellini Anguilera, Datos para la Geologia de Mexico, 1893, p. 18.
Loc. Europe; Mexico.

Terebratula robusta Whiteaves. Jurassic (?Cretaceous).
Terebratula robusta Whiteaves, Cont. Canadian Pal., I, 1889, p. 163, pl. 22, figs. 1, 2.
Loc. Rocky Mountains, near Devils Lake, Canada.
Obs. The horizon of this locality is probably Jurassic (Stanton).

Terebratula rockymontana Marcou=Pugnax rockymontana.
Terebratula romingeri Hall=Cranæna romingeri.
Terebratula rowleyi Worthen=Dielasma rowleyi.
Terebratula royssii d'Orbigny (non L'Éveillé)=Seminula argentea.
Terebratula royssii Marcou=Cleiothyris roissyi.
Terebratula sacculus Dawson, and Davidson=Dielasma sacculus.

Terebratula semisimplex White. Triassic.
Terebratula semisimplex White, Bull. U. S. Geol. Survey Terr., V, 1879, p. 108.
Loc. Southeastern Idaho.

Terebratula serpentina Owen=Eumetria marcyi.
Terebratula shumardana Miller=Dielasma shumardanum.
Terebratula simulator Hall=Eunella simulator.
Terebratula spiriferoides Eaton=Athyris spiriferoides.

Terebratula subexcavata Conrad. Oolite or Cretaceous.
Terebratula subexcavata Conrad, U. S. Astronomical Exped. to the Southern Hemisphere, 1855, p. 282, pl. 41, fig. 4.
Loc. Cordillera de Dona Ana, Chile.

Terebratula subfragilis d'Orbigny=T. harlani.

Terebratula subovoides Roemer. Lias (Jurassic).
Terebratula ornithocephala (non Sowerby) Bayle and Coquand, Mém. Soc. Géol. France, 2d ser, IV, 1851, p. 18, pl. 8, figs. 12-14.
Terebratula subovoides Behrendsen, Zeit. der Deutschen Geol. Gessel., XLIII, 1891, p. 395.—Möricke, Neues Jahrb., f. Mineral., Beilageband, IX, 1894, p. 66.
Loc. Europe; Valle lenas amorillas, Rio Salado, Argentine Republic; Mine Amolanas, Manflas, and Tres Cruces, Chile.

Terebratula subnumismalis Davidson?. Lias (Jurassic).
Terebratula subnumismalis Davidson, British Oolitic and Liassic Brach., Pal. Soc., 1852, p. 36, pl. 51, fig. 10.
Terebratula cfr. subnumismalis Behrendsen, Zeit. der. Deutschen Geol. Gessel., XLIII, 1891, p. 396.
Loc. Europe; Rio Salado, Argentine Republic.

Terebratula subretziforma McChesney. Kaskaskia (L. Carb.).
Terebratula subretziaforma McChesney, Descrip. New Fossils, 1861, p. 82.
Loc. Fountain Bluff, Illinois.

Terebratula subtetrædra Conrad=Rhynchonella anduin.
Terebratula subtilita Hall=Seminula argentea.
Terebratula sullivanti Hall=Eunella sullivanti.

Terebratula swallovana Miller. Kaskaskia (L. Carb.).

Terebratula gracilis Swallow (non von Buch)? Trans. St. Louis Acad. Sci., II, 1863, p. 83.

Terebratula swallovana Miller, American Pal. Foss., 2d ed., 1883, p. 299.

Loc. St. Marys, Missouri; Chester, Illinois.

Terebratula tayloriana Lea=Rhynchonella tayloriana.

Terebratula tetrædra Sowerby=Rhynchonella tetrædra.

Terebratula titicacensis Gabb=Seminula titicacaensis.

Terebratula traversensis A. Winchell. Hamilton (Dev.).

Terebratula traversensis A. Winchell, Rep. Lower Peninsula Michigan, 1866, p. 95.

Loc. Grand Traverse region, Michigan.

Terebratula trinitatensis Guppy. Eocene.

Terebratula trinitatensis Guppy, Quart. Jour. Geol. Soc. London, XXII, 1866, p. 296, pl. 19, fig. 1.

Loc. Sanfernando, Trinidad.

Terebratula trinucleus Hall=Seminula trinucleus.

Terebratula turgida Hall=Dielasma turgidum.

Terebratula turpis Verneuil=Clitambonites borealis.

Terebratula utah Marcou (non Hall and Whitfield)=Pugnax utah.

Terebratula (?) utah Hall and Whitfield. Lower Carboniferous.

Terebratula utah Hall and Whitfield, King's Geol. Expl. 40th Parl., IV, 1877, p. 258, pl. 4, fig. 18.

Loc. Cottonwood Divide, Wasatch Range, Utah.

Obs. Not well established. Based upon a single dorsal valve. May be a Dielasma.

Terebratula valenciennii Castelnau=Meristella nasuta.

Terebratula wacoensis Roemer=Kingena wacoensis.

Terebratula wilmingtonensis Lyell and Sowerby=Rhynchonella wilmingtonensis.

Terebratula (?) cfr. zieteni Loriol. Jurassic.

Terebratula cfr. zieteni Aguilera, Bol. Com. Geológica de Mexico, I, 1895, p. 1, pl. 2, figs. 6, 7.

Loc. Rancho Alamitos, Sierra de Catorce, Mexico.

TEREBRATULINA d'Orb. Genotype Anomia caputserpentis Linné.

Terebratulina d'Orbigny, Ann. Des. Sci. Nat., VIII, 1848, p. 67.—Hall and Clarke, Thirteenth Ann. Rep. N. Y. State Geol., 1895, p. 872.

Terebratulina atlantica (Morton). Upper Cretaceous.

Terebratula atlantica Morton, Jour. Acad. Nat. Sci. Philadelphia, VIII, 1842, p. 214.

Terebratula halliana Gabb, Proc. Acad. Nat. Sci. Philadelphia, V, 1861, p. 19.

Terebratulina halliana Gabb, Proc. American Phil. Soc., VIII, 1861, p. 200.

Terebratula glossa Conrad, American Jour. Conch., V, 1869, p. 42, pl. 1, fig. 22.

Terebratulina atlantica Whitfield, Mon. U. S. Geol. Survey, IX, 1885, p. 9, pl. 1, figs. 10-13.—Hollick, Trans. N. Y. Acad. Sci., XI, 1892, p. 98, pl. 1, fig. 8.

Loc. New Jersey; Tottenville, Staten Island.

Terebratulina filosa Conrad. ?Cretaceous.

Terebratulina filosa Conrad, American Jour. Conch., II, 1866, pp. 77, 105, pl. 9, figs. 4, 5.

Loc. Uniontown, Alabama.

Terebratulina floridana (Morton). Cretaceous.

Terebratula floridana Morton, Syn. Cret. U. S., 1834, p. 72, pl. 16, fig. 17.

Terebratulina floridana d'Orbigny, Prod. Pal., II, 1849, p. 258.—Whitfield, Mon. U. S. Geol. Survey, IX, 1885, p. 11.

Loc. Prairie Bluff, Alabama.

Terebratulina gracilis (Schlotheim). Eocene.

Terebratula gracilis Schlotheim, Die Petrefactenkunde, 1820, p. 270.

Terebratulina gracilis Conrad, American Jour. Conch., I, 1865, p. 15.

Loc. Europe; Alabama.

Terebratulina guadalupæ (Roemer). Upper Cretaceous.

Terebratula gaudalupæ Roemer, Texas, 1849, p. 408;—Kreidebildung von Texas, 1852, p. 82, pl. 6, fig. 3.—Gabb, Proc. Acad. Nat. Sci. Philadelphia, 1861, p. 19.

Loc. New Braunfels, Austin, and 200 miles north in Dallas County, Texas (Hill).

Terebratulina halliana Gabb=T. atlantica.

Terebratulina lachryma (Morton). (Cretaceous?) Eocene?.

Terebratula lachryma Morton, Syn. Cret. U. S., 1834, p. 72, pl. 10, fig. 11; pl. 16, fig. 6.

Terebratulina lachryma d'Orbigny, Prod. Pal., 1849, p. 396.—Gabb, Proc. Acad. Nat. Sci. Philadelphia, 1861, p. 19;—Proc. American Phil. Soc., VIII, 1861 p. 200.—Conrad, American Jour. Conch., I, 1865, p. 15.—Whitfield, Mon. U. S. Geol. Survey, IX, 1885, p. 12, pl. 1, fig. 14.

Loc. New Jersey; Claiborne, Alabama.

TORYNIFER Hall and Clarke. Genotype T. criticus Hall and Clarke.

Torynifer Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, explanation to pl. 84.

Torynifer criticus Hall and Clarke. St. Louis (L. Carb.).

Torynifer criticus Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 84, figs. 34, 35.

TREMATIS Sharpe.

Genotype Orbicula terminalis Sharpe (non Emmons)=T. millipunctata Hall.

Trematis Sharpe, Quart. Jour. Geol. Soc. London, IV, 1847, p. 66.—Dall, Bull. Mus. Comp. Zool., III, 1871, p. 37;—Bull. U. S. Nat. Mus., 8, 1877, p. 73.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 138, 168.—Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 367.—Hall and Clarke, Eleventh Ann. Rep. N. Y. State Geologist, 1894, p. 258.

Trematis crassipuncta Ulrich. Lorraine (Ord.).

Trematis crassipuncta Ulrich, American Geologist, IV, 1889, p. 22; III, p. 378, fig. 7.

Loc. Cincinnati, Ohio.

Trematis (?) dyeri Miller. Lorraine (Ord.).

Trematis dyeri Miller, Cincinnati Quart. Jour. Sci., I, 1874, p. 347, fig. 39.

Trematis (?) dyeri Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 142.

Loc. Cincinnati, Ohio.

Trematis filosa Billings=Schizocrania filosa.

Trematis fragilis Ulrich. Trenton (Ord.).

Trematis fragilis Ulrich, American Geologist, IV, 1889, p. 21; III, p. 378, fig. 6.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 142, pl. 4G, fig. 14.

Loc. Near Covington, Kentucky.

Trematis huronensis Billings. Black River (Ord.).

Trematis huronensis Billings, Pal. Fossils, I, 1862, p. 53, fig. 59 on p. 52;—Geol. Canada, 1863, p. 159, fig. 130.

Productella minneapolis Sardeson, Bull. Minnesota Acad. Nat. Sci., III, 1892, p. 332, pl. 4, figs. 11, 12.

Trematis huronensis? Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 368, fig. 29.

Loc. Pallideau Islands, Lake Huron; Minneapolis, Minnesota.

Trematis millepunctata Hall. Utica and Lorraine (Ord.).

Trematis millepunctata Hall, Description n. sp. Crinoidea and other Fossils, 1866, p. 14;—Twenty-fourth Rep. N. Y. State Cab. Nat. Hist., 1872, p. 221, pl. 7, figs. 22–25.—Hall and Whitfield, Pal. Ohio, II, 1875, p. 70, pl. 1, figs. 4–7.—Miller, Cincinnati Quart. Jour. Sci., II, 1875, p. 16.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 139, pl. 4G, figs. 4–10.

Loc. Cincinnati, Ohio.

Obs. See T. quincuncialis and T. reticularis.

Trematis montrealensis Billings. Trenton (Ord.).

Trematis montrealensis Billings, Pal. Fossils, I, 1862, p. 52, fig. 57;—Geol. Canada, 1863, p. 159, fig. 128.

Loc. Montreal, Canada.

Trematis oblata Ulrich. Utica and Lorraine (Ord.).

Trematis punctostriata Hall and Whitfield (non Hall, 1873), Pal. Ohio, II, 1875, p. 70, pl. 1, figs. 8, 9.

Trematis oblata Ulrich, American Geologist, IV, 1889, p. 23; III, p. 378, fig. 9.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 142, pl. 4G, fig. 20.

Loc. Cincinnati, Ohio.

Trematis ottawaensis Billings. Trenton and Lorraine (Ord.).

Trematis ottawaensis Billings, Pal. Fossils, I, 1862, p. 53, fig. 58 on p. 52;—Geol. Canada, 1863, p. 159, fig. 129;—Cat. Sil. Fossils Anticosti, 1866, p. 11.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 139, pl. 4G, figs. 15–17.—Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 369, fig. 30.

Loc. Ottawa, Canada; Anticosti; Trenton Falls, New York; Frankfort, Kentucky; St. Paul, Minnesota.

Trematis? pannulus White=Iphidea pannulus.

Trematis punctostriata Hall and Whitfield=T. oblata.

Trematis punctistriata Hall. Lorraine (Ord.).

Trematis punctostriata Hall, Twenty-third Rep. N. Y. State Cab. Nat. Hist., 1873, p. 243, pl. 13, figs. 17, 18.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 142, pl. 4G, figs. 11–13 (?3).

Loc. Clifton, Tennessee.

Trematis (?) pustulosa Hall. Lorraine (Ord.).

Trematis? pustulosa Hall, Descrip. n. sp. Crinoidea and other Fossils, 1866, p. 15;—Twenty-fourth Rep. N. Y. State Cab. Nat. Hist., 1872, p. 222.

Loc. Near Horicon, Wisconsin.

Trematis quincuncialis Miller and Dyer. Lorraine (Ord.).

Trematis quincuncialis Miller and Dyer, Cont. to Pal., II, 1878, p. 8, pl. 3, fig. 9.

Loc. Lebanon, Ohio.

Obs. Seems to be only a variety of T. millepunctata occurring at a higher horizon.

Trematis reticularis (Miller). Lorraine (Ord.).

Crania reticularis Miller, Cincinnati Quart. Jour. Sci., II, 1875, p. 280, fig. 1.

Loc. Brookville, Indiana.

Obs. The type specimens have been examined and appear to be young T. millepunctata.

Trematis rudis Hall=Schizocrania rudis.

Trematis terminalis Emmons. Trenton (Ord.).

Orbicula terminalis Emmons, Geol. New York; Rep. Second Dist., 1842, p. 395, fig. 4.—Hall, Pal. New York, I, 1847, p. 100, pl. 30, fig. 11.

Trematis terminalis Emmons, American Geologist, Pt. II, 1855, p. 201, fig. 63.—Billings, Geol. Canada, 1863, p. 159, fig. 127.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 139, pl. 4G, figs. 1, 2.

† Trematis terminalis Miller, Cincinnati Quart. Jour. Sci., II, 1875, p. 14.

Loc. Middleville, Trenton Falls, Watertown, and elsewhere in New York.

Trematis truncata Hall=Schizobolus concentricus.

Trematis umbonata Ulrich. Lorraine (Ord.).

Trematis umbonata Ulrich, American Geologist, IV, 1889, p. 23; III, 1889, fig. 8 on p. 378.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 139, pl. 4G, figs. 18, 19.

Loc. Covington, Kentucky; Cincinnati, Ohio.

TREMATOBOLUS Matthew. Genotype T. insignis Matthew.

Trematobolus Matthew, Canadian Rec. Science, 1893, p. 276.—Hall and Clarke, Eleventh Ann. Rep. N. Y. State Geol., 1894, p. 252.

Trematobolus insignis Matthew. Middle Cambrian.

Trematobolus insignis Matthew, Canadian Record Science, 1893, p. 276, fig. 1;—Trans. Royal Soc. Canada, Vol. XI, 1894, p. 88, pl. 16, fig. 4a–d;—Trans. N. Y. Acad. Sci., XIV, 1895, p. 122, pl. 4, fig. 2.

Loc. St. Martins, New Brunswick.

TREMATOSPIRA Hall. Genotype Spirifer? perforatus Hall.

Trematospira Hall, Pal. New York, III, 1859, p. 207;—Twelfth Rep. N. Y. State Cab. Nat. Hist., 1859, p. 27;—Pal. New York, IV, 1867, p. 271.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 135.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 124;—Thirteenth Ann. Rep. N. Y. State Geologist, 1895, p. 798.

† Trematospira Hall, Sixteenth Rep. N. Y. State Cab. Nat. Hist., 1863, p. 54.

Trematospira acadiæ Hall and Clarke=Rhynchospira acadiæ.

Trematospira camura Hall. Niagara (Sil.).

Atrypa camura Hall, Pal. New York, II, 1852, p. 273, pl. 56, fig. 3.

Trematospira camura Hall, Pal. New York, III, 1859, p. 212, pl. 28A, fig. 1.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 126, pl. 49, figs. 2–4.

Rhynchonella camura Billings, Geol. Canada, 1863, p. 315, fig. 322.

Loc. Lockport, New York.

Trematospira costata Hall. Lower Helderberg (Dev.).

Trematospira costata Hall, Pal. New York, III, 1859, p. 210, pl. 28A, 1859, fig. 4;—Ibidem, IV, 1867, p. 276, figs. 5, 6.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 49, figs. 19, 20.

Loc. Albany and Schoharie counties, New York.

Trematospira deweyi Hall=Parazyga deweyi.

Trematospira disparilis Hall=Atrypina disparilis.

Trematospira dubia (Billings). Lower Helderberg (Dev.).

Retzia dubia Billings, Proc. Portland Soc. Nat. Hist., I, 1863, p. 113, pl. 3, fig. 10.

Trematospira dubia Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 126, pl. 49, figs. 15, 16.

Loc. Square Lake, Maine.

Trematospira equistriata Hall and Clarke. Lower Helderberg (Dev.).

Trematospira equistriata Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 49, fig. 47.

Loc. Cumberland, Maryland.

Trematospira gibbosa Hall. Hamilton (Dev.).

Trematospira gibbosa Hall, Thirteenth Rep. N. Y. State Cab. Nat. Hist., 1860, p. 82;—Pal. New York, IV, 1867, p. 272, pl. 45, figs. 7–15.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 49, figs. 23–27.

Loc. Bellona, York, and Darien, New York.

Trematospira helena Nettelroth=Rhynchospira helena.

Trematospira hippolyte (Billings). Lower Helderberg (Dev.).

Retzia hippolyte Billings, Proc. Portland Soc. Nat. Hist., 1863, p. 112, pl. 13, fig. 9.

Trematospira hippolyte Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 126, pl. 49, figs. 7, 8.

Loc. Square Lake, Maine.

Trematospira hirsuta Hall=Parazyga hirsuta.

Trematospira imbricata Hall=Atrypina imbricata.

Trematospira (?) liniuscula A. Winchell. Hamilton (Dev.).

Trematospira ? liniuscula A. Winchell, Rep. Lower Peninsula Michigan, 1866, p. 94.

Loc. Grand Traverse region, Michigan.

Trematospira matthewsoni McChesney=Atrypa marginalis.

Trematospira maria (Billings). Lower Helderberg (Dev.).

Retzia maria Billings, Proc. Portland Soc. Nat. Hist., 1863, p. 112, pl. 3, fig. 8.

Trematospira maria Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 126, pl. 49, fig. 21.

Loc. Square Lake, Maine.

Trematospira multistriata Hall. Lower Helderberg (Dev.).

Spirifer multistriata Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 59, figs. 1–6.

Trematospira multistriata Hall, Pal. New York, III, 1859, p. 209, pl. 24, fig. 3; pl. 28A, fig. 5;—Ibidem, IV, 1867, p. 276, figs. 1–3.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 126, fig. 110, pl. 49, figs. 9–14.

Retzia multistriata Billings, Geol. Canada, 1863, p. 958, fig. 458.

Loc. Schoharie, New York.

Trematospira nobilis Hall=Cyclorhina nobilis.

Trematospira perforata Hall. Lower Helderberg (Dev.).

Spirifer ? perforata Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 60.

Trematospira perforata Hall, Pal. New York, III, 1859, p. 208, pl. 28A, fig. 3;—Ibidem, IV, 1867, p. 276.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 49, figs. 5, 6.

Loc. Albany and Schoharie counties and Hudson, New York.

Trematospira simplex Hall. Lower Helderberg (Dev.).

Trematospira simplex Hall, Pal. New York, III, 1859, p. 211, pl. 28A, fig. 2.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 49, figs. 17, 18.

Loc. Decatur County, Tennessee.

Trematospira quadriplicata Miller=Rhynchotrema inæquivalve.

Trematospira tennesseensis Hall and Clarke. Lower Helderberg (Dev.).

Trematospira tennesseensis Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 83, figs. 21–23.

Loc. Perry County, Tennessee.

TRIGERIA (Bayle partim) Hall and Clarke.

Genotype Terebratula guerangeri de Verneuil.

Trigeria Bayle (partim), Explic. Carte Géol de France, Atlas, 1875, pl. 13.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pp. 272, 273, fig. 189;—Thirteenth Rep. N. Y. State Geologist, 1895, p. 856.

Trigeria gaudryi (Œhlert). Oriskany (Dev.).

Centronella gaudryi Œhlert, Bull. Soc. Geol. France, 3d ser., V, 1877, p. 593, pl. 10, fig. 8;—Bull. de la Soc. d'Etudes Scientif. d'Angers, separate 1883, p. 2, pl. —. figs. 10–17.

Trigeria gaudryi Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 273, fig. 189, pl. 76, figs. 6, 7.

Loc. France; Cumberland, Maryland.

Trigeria (?) lepida Hall. Hamilton (Dev.).

Rhynchospira lepida Hall, Thirteenth Rep. N. Y. State Cab. Nat. Hist., 1860, p. 83;—Pal. New York, IV, 1867, p. 276, pl. 45, figs. 1–6.

Retzia lepida Miller, N. American Geol. Pal., 1889, p. 366.

Trigeria ? lepida Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 274, pl. 50, figs. 36–40.

Loc. Canandaigua Lake and Bellona, New York.

Trigeria (?) margarida (Derby). Middle Devonian.

Centronella (?) margarida Derby, Archivos do Museu Nacional Rio de Janeiro, IX, 1890, p. 84, with figures in text.

Trigeria ? margarida Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 274.

Loc. Head of Paraguay; Matto Grosso, Brazil.

Trigeria (?) portlandica (Billings). Lower Helderberg (Dev.).

Rensselæria portlandica Billings, Proc. Portland Soc. Nat. Hist., I, 1863, p. 115, pl. 3, fig. 12.

Trigeria ? portlandica Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 273, pl. 76, figs. 4, 5.

Loc. Square Lake, Maine.

Trigeria (?) wardiana (Rathbun). Middle Devonian.

Retzia wardiana (Hartt) Rathbun, Bull. Buffalo Soc. Nat. Sci., I, 1874, p. 245, pl. 10, figs. 2–5, 8, 9, 11, 12, 14, 16.—Rathbun, Proc. Boston Soc. Nat. Hist., XX, 1879, p. 31.

Retzia ? wardiana Derby, Archivos do Museu Nacional do Rio de Janerio, IX, 1890, p. 78.

Trigeria ? wardiana Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 274.

Loc. Province of Para, Brazil.

TRIMERELLA Billings. Genotype T. grandis Billings.

Trimerella Billings, Pal. Fossils, I, 1862, p. 166.—Dall, American Jour. Conch., VI, 1870, p. 160;—Ibidem, VII, 1871, p. 79.—Davidson and King, Quart. Jour. Geol. Soc. London, XXX, 1874, p. 143.—Dall, Bull. U. S. National Mus., 8, 1877, p. 74.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pp. 33, 46, 163;—Eleventh Ann. Rep. N. Y. State Geologist, 1894, p. 236.

Gotlandia Dall, American Jour. Conch., VI, 1870, p. 160.

Trimerella acuminata Billings. Guelph (Sil.).

Trimerella acuminata Billings, Pal. Fossils, I, 1862, pp. 167, 168, fig. 152;—American Jour. Sci., 3d ser., I, 1871, p. 471;—Ann. Mag. Nat. Hist., 4th ser., VIII, 1871, p. 140.—Dall, American Jour. Conch., VII, 1871, p. 82.—Davidson and King, Quart. Jour. Geol. Soc. London, XXX, 1874, p. 146, pl. 15, figs. 4–7; pl. 16, figs. 1, 2.—Nicholson, Pal. Prov. Ontario, 1875, p. 68, fig. 36.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 4B, fig. 6.

Loc. Galt, New Hope, and Hespelar, Ontario; near Hillsboro, Ohio; Port Byron, Illinois; Gotland and Farö.

Trimerella billingsi Dall. Guelph (Sil.).

Trimerella billingsi Dall, American Jour. Conch., VII, 1871, p. 82, pl. 11, figs. 1-3.—Davidson and King, Quart. Jour. Geol. Soc. London, XXX, 1874, p. 150, pl. 16, figs. 8, 9.

Loc. New Hope, Ontario, Canada.

Trimerella dalli Davidson and King. Guelph (Sil.).

Trimerella dalli Davidson and King, Quart. Jour. Geol. Soc. London, XXX, 1874, p. 154, pl. 15, figs. 1-3.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 4A, fig. 10.

Loc. Hespelar, Elora, and New Hope, Ontario, Canada.

Trimerella galtensis Hall=Rhinobolus galtensis.

Trimerella grandis Billings. Guelph (Sil.).

Trimerella grandis Billings, Pal. Fossils, I, 1862, pp. 166, 167, fig. 151.—Dall, American Jour. Conch., II, 1870, p. 160;—Ibidem, VII, 1871, p. 82.—Hall, Twenty-third Rep. N. Y. State Cab. Nat. Hist., 1873, pl. 13, figs. 11–16.—Davidson and King, Quart. Jour. Geol. Soc. London, XXX, 1874, pl. 13, figs. 2, 3.—Nicholson, Pal. Prov. Ontario, 1875, p. 67, fig. 37.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 4A, figs. 1, 2; pl. 4B, figs. 2–5.

Loc. Galt, New Hope, and Elora, Hespelar, Ontario, Canada; near Hillsboro, Ohio; Wisconsin.

Trimerella minor Dall=Rhinobolus galtensis.

Trimerella ohioensis Meek. Niagara (Sil.).

Trimerella ohioensis Meek, American Jour. Sci., 3d ser., I, 1871, p. 305.—Dall, American Jour. Conch., VII, 1871, p. 83.—Davidson and King, Geol. Mag., IX, 1872.—Meek, Pal. Ohio, I, 1873, p. 183, pl. 16, fig. 1.—Davidson and King, Quart. Jour. Geol. Soc. London, XXX, 1874, p. 153, pl. 16, figs. 3–7; pl. 19, figs. 1-2.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, pl. 4A, figs. 3-9.

Loc. Genoa, Ottawa County, Ohio; Port Byron, Illinois; Ontario, Canada.

TRIPLECIA Hall. Genotype Atrypa extans Emmons.

Triplesia Hall, Pal. New York, III, 1859, p. 522;—Twelfth Rep. N. Y. State Cab Nat. Hist., 1859, p. 44.—Waagen, Palæontologica Indica, Ser. XIII, I, 1884, p. 576.

Triplecia Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 269.—Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 408.—Hall and Clarke, Eleventh Ann. Rep. N. Y. State Geologist, 1894, p. 289.

Dicraniscus Meek, American Jour. Sci., 3d ser., IV, 1872, p. 279.—Pal. Ohio, I, 1873, p. 576.

Triplecia cuspidata Hall. Trenton (Ord.).

Atrypa cuspidata Hall, Pal. New York, I, 1847, p. 138, pl. 33*, fig. 1, and p. 318.

Triplesia cuspidata Hall, Pal. New York, III, 1859, p. 522.—Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 270.

Loc. Lowville, Lewis County, New York.

Triplecia extans (Emmons). Trenton (Ord.).

Atrypa extans Emmons, Geol. N. Y.; Rep. Second Dist., 1842, p. 395, fig. 6.—Hall, Pal. New York, I, 1847, p. 137, pl. 33, fig. 1.

Triplesia extans, Hall, Ibidem, III, 1859, p. 523, figs. 1–3.

Triplecia extans Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 270, pl. 11C, figs. 1–7.

Loc. Watertown, Lowville, and Boonville, New York.

Triplecia niagaraensis Hall and Clarke. Niagara (Sil.).

Triplecia niagarensis Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 83, figs. 16–20.

Loc. Near Milwaukee, Wisconsin.

Triplecia nucleus Hall. Trenton (Ord.).

Atrypa nucleus Hall, Pal. New York, I, 1847, p. 138, pl. 33, fig. 2.

Triplesia nucleus Hall, Ibidem, III, 1859, p. 522.

Triplecia nucleus, Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 270, pl. 11C, figs. 8, 9.

Loc. Middleville, New York.

Triplecia ortoni Meek. Clinton (Sil.).

Dicraniscus ortoni Meek, American Jour. Sci., 3d ser., IV, 1872, p. 280.

Triplesia ortoni Meek, Pal. Ohio, I, 1873, p. 178, pl. 15, fig. 1.

Triplecia ortoni, Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 270; pl. 11C, figs. 12–20.—Foerste, Geol. Ohio, VII, 1895, p. 585.

Loc. Dayton, Ohio; Newson, Tennessee.

Triplecia (?) radiata Whitfield. Calciferous (Ord.).

Triplesia radiata Whitfield, Bull. American Mus. Nat. Hist., II, 1889, p. 43, pl. 7, figs. 5–8.

Triplecia radiata, Hall and Clarke, Pal. New York, VIII, Pt. I, 1892, p. 271.

Loc. Beekmantown, New York.

Triplecia ulrichi Winchell and Schuchert. Lorraine (Ord.).

Triplecia ulrichi W. and S., Minnesota Geol. Survey, III, 1893, p. 409, fig. 34.

Loc. Wykoff and Spring Valley, Minnesota.

Triplesia ambigua Hall = Camarella ambigua.

Triplesia calcifera Walcott = Syntrophia calcifera.

Triplesia congesta Hall = Hyattella congesta.

Triplesia lateralis Whitfield = Syntrophia lateralis.

Triplesia primordialis Whitfield = Syntrophia primordialis.

Triplesia putillus Hall = Mimulus waldronensis.

Triplesia quadricostata Hall = Hyattella congesta.

TROPIDOLEPTUS Hall. Genotype Strophomena carinata Conrad.

Tropidoleptus Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 152. (undefined);—Twelfth Rep. Ibidem, 1859, p. 31 (undefined); Twentieth Rep.—Ibidem, 1867, pp. 165, 279;—Pal. New York, IV, 1867, p. 404.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 46.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 302;—Thirteenth Ann. Rep. N. Y. State Geologist, 1895, p. 870.

Tropidoleptus carinatus (Conrad). Marcellus and Hamilton (Dev.).

Strophomena carinata Conrad, Third Ann. Rep. N. Y. Geol. Survey, 1839, p. 64.

Leptæna laticosta (Hall) de Verneuil, Bull. Soc. Geol. France, 2d ser., IV, 1847, p. 703.

Tropidoleptus carinatus Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 151, figs. 1, 2;—Twelfth Rep. N. Y. State Cab. Nat. Hist., 1859, p. 31, figs.

Tropidoleptus carinatus (Conrad)—Continued.

1–4.—Rogers, Geol. Pennsylvania, II, Pt. II, 1858, p. 828, fig. 672.—Hall, Pal. New York, IV, 1867, p. 407, pl. 62, figs. 2, 3.—Meek and Worthen, Geol. Survey Illinois, III, 1868, p. 427, pl. 13, fig. 2.—Rathbun, Bull. Buffalo Soc. Nat. Sci., I, 1874, p. 254, pl. 9, figs. 1, 9, 10, 26.—Derby, Bull. Mus. Comp. Zool., III, 1876, p. 282.—Rathbun, Proc. Boston Soc. Nat. Hist., XX, 1879, p. 35.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 146, pl. 17, figs. 14, 15.—A. Ulrich, N. Jahrb. f. Mineral., Beilageband, VIII, 1892, p. 73, pl. 4, figs. 32–34.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 304, figs. 227, 228, pl. 82, figs. 26–36.

Loc. New York; Falls of Ohio; Columbus, Ohio; Pennsylvania; Jackson County, Illinois; Erere, Province of Para, Brazil; Island of Coati, Lake Titicaca (Agassiz), and Rio Sicasica (Ulrich), Bolivia, South America; South Africa (Ulrich); France; Germany and England.

Tropidoleptus occidens Hall. Hamilton (Dev.).

Tropidoleptus occidens Hall, Thirteenth Rep. N. Y. State Cab. Nat. Hist., 1860, p. 91;—Pal. New York, IV, 1867, p. 408, pl. 61A, figs. 50–52.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 82, figs. 37, 38.

Loc. Iowa City, Iowa.

UNCINULUS Bayle. Genotype Rhynchonella subwilsoni d'Orbigny.

Uncinulus Bayle, Explic. de la Carte Géolog. France, IV, Atlas, 1878, pl. 11, figs. 17–20.—Waagen, Palæontologica Indica, Ser. XIII, I, 1883, p. 424.—Œhlert, Fischer's Manuel de Conchyliologie, 1887, p. 1306.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 195;—Thirteenth Ann. Rep. N. Y. State Geologist, 1895, p. 828.

Uncinulus abruptus Hall. Lower Helderberg (Dev.).

Rhynchonella abrupta Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 68, fig. 1;—Pal. New York, III, 1859, p. 228, pl. 31, fig. 3.

Uncinulus abruptus Hall and Clarke, VIII, Pt. II, 1893, p. 199, pl. 58, figs. 15–21.

Loc. Albany and Schoharie counties, New York.

Uncinulus campbellanus (Hall). Lower Helderberg (Dev.).

Rhynchonella campbellana Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 79;—Pal. New York, III, 1859, p. 239, pl. 43, fig. 2.

Loc. Albany County, New York.

Uncinulus mutabilis Hall. Lower Helderberg (Dev.).

Rhynchonella mutabilis Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 66, figs. 1–7;—Pal. New York, III, 1859, p. 225, pl. 29, fig. 4; pl. 30, figs. 1, 2.

Uncinulus mutabilis Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 199, pl. 58, figs. 22–25.

Loc. Schoharie and Carlisle, New York.

Uncinulus nobilis Hall. Lower Helderberg (Dev.).

Rhynchonella nobilis Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 80, figs. 1–3.—Rogers, Geol. Pennsylvania, II, 1858, p. 825, fig. 645.—Hall, Pal. New York, III, 1859, p. 240, pl. 43, fig. 3.

Uncinulus nobilis Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 58, fig. 26.

Loc. Albany and Schoharie counties, New York; Pennsylvania.

Uncinulus nucleolatus Hall. Lower Helderberg (Dev.).

Rhynchonella nucleolata Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 68;—Pal. New York, III, 1859, p. 227, pl. 31, figs. 1f, 2.—Billings, Proc. Portland Soc. Nat. Hist., 1863, p. 110, pl. 3, fig. 5.

Uncinulus nucleolatus Hall—Continued.

Uncinulus nucleolata Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 199.

Loc. Schoharie and Carlisle, New York; Square Lake, Maine; St. Blandine, New Brunswick, Canada.

Uncinulus pyramidatus Hall. Lower Helderberg (Dev.).

Rhynchonella pyramidata Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, p. 70;—Pal. New York, III, 1859, p. 229, pl. 32, figs. 1, 2.

Uncinulus pyramidatus Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 58, figs. 27, 28.

Loc. Albany County, New York.

Uncinulus stricklandi (Sowerby). Niagara (Sil.).

Terebratula stricklandi Sowerby, Murchison's Sil. System, 1839, pl. 13, fig. 19.

Rhynchonella tennesseensis Hall (non Roemer), Trans. Albany Institute, IV, 1860, p. 228;—Twenty-eighth Rep. N. Y. State Mus. Nat. Hist., Doc. ed., 1876, pl. 26, figs. 34–40.—White, Second Ann. Rep. Indiana Bureau of Statistics and Geol., 1880, p. 496, pl. 3, figs. 2–4;—Tenth Rep. State Geol. Indiana, 1881, p. 128, pl. 3, figs. 2–4.

Rhynchonella stricklandi Hall, Twenty-eighth Rep. N. Y. State Mus. Nat. Hist., Doc. ed., 1879, p. 165, pl. 26, figs. 34–40;—Eleventh Rep. State Geol. Indiana, 1882, p. 308, pl. 26, figs. 34–40.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 81, pl. 27, figs. 9–11; pl. 29, figs. 3–6.

Uncinulus (Uncinulina) stricklandi Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 58, figs. 38–40.

Loc. Europe; Waldron, Indiana; Louisville, Kentucky.

Uncinulus vellicatus Hall. Lower Helderberg (Dev.).

Rhynchonella vellicata Hall, Tenth Rep. N. Y. State Cab. Nat. Hist., 1857, pp. 69, 71, figs. 2, 3;—Pal. New York, III, 1859, p. 230, pl. 33, fig. 1.

Uncinulus vellicata Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, p. 199.

Loc. Albany and Schoharie counties, New York; Dalhousie, New Brunswick, Canada.

VITULINA Hall. Genotype V. pustulosa Hall.

Vitulina Hall, Thirteenth Rep. N. Y. State Cab. Nat. Hist., 1860, p. 72, figs. 1, 2;—Pal. New York, IV, 1867, p. 410.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 138;—Thirteenth Ann. Rep. N. Y. State Geologist, 1895, p. 804.

Vitulina pustulosa Hall. Hamilton (Dev.).

Vitulina pustulosa Hall, Thirteenth Rep. N. Y. State Cab. Nat. Hist., 1860, p. 82;—Pal. New York, IV, 1867, p. 410, pl. 62, fig. 1.—Rathbun, Bull. Buffalo Soc. Nat. Sci., I, 1874, p. 255, pl. 9, figs. 2, 6–8, 11–13, 15, 20, 21, 27, 32.—Derby, Bull. Mus. Comp. Zool., III, 1876, p. 282.—Rathbun, Proc. Boston Soc. Nat. Hist., XX, 1879, p. 36.—A. Ulrich, N. Jahrb. f. Mineral., Beilageband, VIII, 1891, p. 273;—Ibidem, Beilageband, VIII, 1892, p. 71, pl. 4, figs. 26–29.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, pp. 139, 317, pl. 82, figs. 18–25.

Loc. Near Tully and Tinkers Falls, New York; Monroe County, Pennsylvania; Erere, Province of Para, and provinces Parana and Matto Grosso, Brazil; island of Coati, Lake Titicaca, Tarabuco and Rio Sicasica, Bolivia; South Africa.

WALDHEIMIA King. Genotype W. flavescens Lamarck.

Waldheimia King, Mon Permian Fossils, Pal. Soc., 1850, p. 81.—Dall, American Jour. Conch., VI, 1870, p. 107.

Waldheimia (?) catorcensis Aguilera. Jurassic.

Waldheimia catorcensis Aguilera, Bol. Com. Geologica de Mexico, I, 1895, p. 1, pl. 2, fig. 8.

Loc. Rancho Alamitos, San Luis, Potosi, Mexico.

Waldheimia compacta White and St. John=Cryptacanthia compacta.
Waldheimia coutinhoana Derby=Harttina coutinhoana.
Waldheimia deweyi Hall=Parazyga deweyi.
Waldheimia formosa Hall=Rhynchospira formosa.
Waldheimia globosa Hall=Rhynchospira globosa.
Waldheimia imbricata Cooper=Terebratella? imbricata.

Waldheimia kennedyi Dall. Miocene.

Waldheimia kennedyi Dall, Proc. California Acad. Sci., 1874 (extract, p. 4).
Loc. Cerros Island, Lower California.

Waldheimia rectirostra Hall=Rhynchospira rectirostris.
Whitfieldia Davidson=Meristina.

WHITFIELDELLA Hall and Clarke. Genotype Atrypa nitida Hall.

Whitfieldella Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 58;—Thirteenth Ann. Rep. N. Y. State Geologist, 1895, p. 766.

Whitfieldella (?) billingsana (Meek and Worthen). Niagara (Sil.).

Centronella billingsiana Meek and Worthen, Geol. Survey Illinois, III, 1868, p. 352, figs. a, b, c; pl. 6, fig. 5.
Loc. Alexander County, Illinois.

Whitfieldella (?) bisulcata (Vanuxem). Lower Helderberg (Dev.).

Atrypa bisulcata Vanuxem, Geol. N. Y.; Rep. Third Dist., 1842, p. 112.
Merista bisulcata Hall, Pal. New York, III, 1859, p. 253.
Loc. Litchfield, New York.

Whitfieldella cylindrica Hall. Clinton-Niagara (Sil.).

Atrypa cylindrica Hall, Pal. New York, II, 1852, p. 76, pl. 24, fig. 2.
Atrypa crassirostra Hall, Pal. New York, 1852, p. 269, pl. 55, fig. 4.
Merista cylindrica Hall, Twelfth Rep. N. Y. State Cab. Nat. Hist., 1859, p. 77.
Athyris cylindrica Billings, Geol. Canada, 1863, p. 317, fig. 333;—Geol. Canada, 1863, p. 317, fig. 332.
Meristella (?Meristina) cylindrica Meek, Pal. Ohio, I, 1873, p. 180, pl. 15, fig. 2.
Whitfieldella cylindrica Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 60, pl. 40, figs. 16–22.
Loc. Lockport, New York; Hillsboro, Ohio; Hamilton, Ontario; Anticosti.

Whitfieldella (?) harpalyce (Billings). Lower Helderberg (Dev.).

Athyris harpalyce Billings, Proc. Portland Soc. Nat. Hist., 1863, p. 116, pl. 3, fig. 14.
Whitfieldella (?) harpalyce Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 60.
Loc. Square Lake, Maine.

Whitfieldella hyale (Billings). Guelph (Sil.).

Charionella ? hyale, Billings, Pal. Fossils, I, 1862, p. 166, fig. 150.
Whitfieldella hyale Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 60.
Charionella hyale Hall and Clarke, Ibidem, pl. 42, figs. 20, 21.
Loc. Galt and Elora, Ontario; Wisconsin (Whitfield).

Whitfieldella intermedia Hall. Clinton-Niagara (Sil.).

Atrypa intermedia Hall, Pal. New York, II, 1852, p. 77, pl. 24, figs. 3, 4, ?6.—Rogers, Geol. Pennsylvania, II, 1858, Pt. II, p. 823, fig. 634.
Merista intermedia Hall, Twelfth Rep. N. Y. State Cab. Nat. Hist., 1859, p. 77.
Athyris intermedia Nicholson and Hinde, Canadian Jour. Sci., XIV, 1874, p. 157.—Nicholson, Pal. Prov. Ontario, 1875, p. 61, fig. 32A.

Whitfieldella intermedia Hall—Continued.

Whitfieldella intermedia Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 60, pl. 40, figs. 1, 2.

Loc. Lockport, New York; Thorold, Ontario; Pennsylvania.

Whitfieldella (?) julia (Billings). Anticosti (Sil.).

Athyris julia Billings, Pal. Fossils, I, 1862, p. 146, fig. 124.

Meristella julia Miller, N. American Geol. Pal., 1889, p. 354.

Loc. Anticosti.

Whitfieldella (?) naviformis Hall. Clinton-Niagara (Sil.).

Atrypa naviformis Hall, Geol. New York; Rep. Fourth Dist., 1843, p. 71, fig. 3;—Pal. New York, II, 1852, p. 76, pl. 24, fig. 1.—Nicholson and Hinde, Canadian Jour. Sci., n. ser., XVI, 1874, pp. 144, 157.

Meristella naviformis Hall, Twelfth Rep. N. Y. State Cab. Nat. Hist., 1859, p. 78.

Athyris naviformis Billings, Geol. Canada, 1863, p. 317, fig. 320.—Nicholson, Pal. Prov. Ontario, 1875, p. 62, fig. 32E.

Whitfieldella naviformis Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 60, pl. 40, fig. 3.

Loc. Rochester, Sodus, etc., New York; Dundas, Ontario; Anticosti.

Whitfieldella nitida Hall. Niagara (Sil.).

Atrypa nitida Hall, Geol. New York; Rep. Fourth Dist., Tables of Organic Remains, 13, 1843, fig. 5;—Pal. New York, II, 1852, p. 268, pl. 55, fig. 1.—Billings, Canadian Nat. Geol., I, 1856, p. 137, pl. 2, fig. 9.

Merista nitida Hall, Twelfth Rep. N. Y. State Cab. Nat. Hist., 1859, p. 78.

Athyris nitida Hall, Geol. Canada, 1863, p. 317, fig. 334.

Meristella nitida Hall, Trans. Albany Institute, IV, 1863, p. 226.

Meristina nitida Hall, Pal. New York, IV, 1867, p. 299;—Twenty-eighth Rep. N. Y. State Mus. Nat. Hist., 1879, p. 169, pl. 25, figs. 1-7;—Eleventh Rep. State Geol. Indiana, 1882, p. 300, pl. 25, figs. 1-7.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 102, pl. 33, figs. 10, 11.—Beecher and Clarke, Mem. N. Y. State Mus., I, 1889, p. 70, pl. 7, figs. 6–10.

Whitfieldella nitida Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 59, figs. 43, 44; pl. 40, figs. 4–13.

Loc. Lockport, etc., New York; Hamilton, Ontario; Waldron, Indiana; Louisville, Kentucky; Anticosti.

Whitfieldella nitida oblata Hall. Niagara (Sil.).

Atrypa nitida var. oblata Hall, Pal. New York, II, 1852, p. 269, pl. 55, fig. 2.

Merista nitida var. oblata Hall, Twelfth Rep. N. Y. State Cab. Nat. Hist., 1859, p. 78.

Loc. Lockport, etc., New York.

Whitfieldella (?) nucleolata (Hall.) Coralline (Sil.).

Atrypa nucleolata Hall, Pal. New York, II, 1852, p. 328, pl. 74, fig. 10.

Merista nucleolata Hall, Twelfth Rep. N. Y. State Cab. Nat. Hist., 1859, p. 78.

Meristella nucleolata Whitfield, Geol. Wisconsin, IV, 1882, p. 321, pl. 25, fig. 5.

Loc. Schoharie, New York; near Milwaukee, Wisconsin.

Whitfieldella oblata Hall. Medina (Sil.).

Atrypa oblata Hall, Pal. New York, II, 1852, p. 9, pl. 4, figs. 4, 5.

Merista oblata Hall, Twelfth Rep. N. Y. State Cab. Nat. Hist., 1859, p. 78.

Whitfieldella (?) oblata Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 60.

Loc. Lockport, New York.

Whitfieldella sulcata (Vanuxem). Waterlime (Sil.).

Atrypa sulcata Vanuxem, Geol. New York; Rep. Third Dist., 1842, p. 112, fig. 5.—Hall, Ibidem, Rep. Fourth Dist., 1843, p. 142, fig. 5.

Merista sulcata Miller, American Pal. Fossils, 1877, p. 115.

Loc. Near Vienna village, New York.

WILSONIA Kayser. Genotype Terebratula wilsoni Sowerby.

Wilsonia Kayser, Zeitschr. d. deutsch. geolog. Gesselsch., XXIII, 1871, p. 502.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 195;—Thirteenth Ann. Rep. N. Y. State Geologist, 1895, p. 827.

Uncinulina Bayle, Explic. de la Carte Géolog. France, IV, 1878, Atlas, pl. 13, figs. 13–16.

Obs. A subgenus of Camarotœchia.

Wilsonia kokomoensis (Miller). Waterlime (Sil.).

Rhynchonella kokomoensis Miller, Eighteenth Ann. Rep. Geol. Survey Indiana, 1894, p. 312, pl. 9, figs. 22-24.

Loc. Kokomo, Indiana.

Wilsonia saffordi Hall. Niagara and Lower Helderberg (Sil. and Dev.).

Rhynchonella saffordi Hall, Canadian Nat. Geol., V, 1860, p. 146.—Hall and Whitfield, Twenty-seventh Rep. N. Y. State Cab. Nat. Hist., 1875, pl. 9, figs. 27-29.—Dawson, Acadian Geol., 3d ed., 1878, p. 598.—Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 79, pl. 27, figs. 22-24; pl. 33, figs. 4–6.

Wilsonia saffordi Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 198, pl. 58, figs. 5–14.

Loc. In the Arisaig group of Nova Scotia; Perry County, Tennessee; Louisville, Kentucky.

Wilsonia saffordi depressa (Nettelroth). Niagara (Sil.).

Rhynchonella saffordi var. depressa Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 80, pl. 33, fig. 1–3.

Loc. Louisville, Kentucky.

Wilsonia wilsoni (Sowerby). Niagara (Sil.).

Terebratula wilsoni Sowerby, Mineral Conchology, 1818, p. 118, fig. 3.

Rhynchonella wilsoni Roemer, Sil. Fauna d. West. Tennessee, 1860, p. 71, pl. 5, fig. 13.

Wilsonia wilsoni Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 198.

Loc. Europe; Decatur County, Tennessee; Louisville, Kentucky; Lake Temiscouata, New Brunswick.

YORKIA Walcott. Genotype Y. wanneri Walcott.

Yorkia Walcott, Proc. U. S. Nat. Mus., XIX, 1897, p. 714.

Yorkia wanneri Walcott. Lower Cambrian.

Yorkia wanneri Walcott, Proc. U. S. Nat. Mus., XIX, 1897, p. 715, pl. 60, figs. 1-1e.

Loc. Emigsville, Pennsylvania.

Yorkia (?) washingtonensis Walcott. Lower Cambrian.

Yorkia (?) washingtonensis Walcott, Proc. U. S. Nat. Mus., XIX, 1897, p. 715, pl. 60, fig. 3.

Loc. Salem, Washington County, New York.

ZYGOSPIRA Hall. Genotype Atrypa modesta Hall.

Stenocisma Hall (non Conrad), Pal. New York, I, 1847, p. 142.—Meek and Hayden, Pal. Upper Missouri, Smithsonian Cont. to Knowl., XIV, 1864, p. 16.

Zygospira Hall, Fifteenth Rep. N. Y. State Cab. Nat. Hist., 1862, p. 154, figs. 1, 2.—Billings, Canadian Nat. Geol., VII, 1862, p. 393.—Hall, Twentieth Rep. N. Y. State Cab. Nat. Hist., 1867, p. 267.—Meek, Geol. Survey, Illinois, III, 1868, p. 377.—Davidson, Suppl. British Silurian Brachiopoda, Pal. Soc., 1882, p. 122.—Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 465.—Beecher and Schuchert, Biol. Soc. Washington, VIII, 1893, pp. 71–82.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 154.

Anazyga Davidson, Suppl. British Silurian Brachiopoda, Pal. Soc., 1882, p. 128.

ZYGOSPIRA Hall—Continued.
Hallina Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 471.
Protozyga Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 151.
Protozyga, Hallina and Zygospira Hall and Clarke, Thirteenth Ann. Rep. N. Y. State Geologist, 1895, pp. 809, 810, 812.

Zygospira æquila Sardeson=Z. nicoletti.

Zygospira anticostiensis Davidson=Catazyga erratica.

Zygospira cincinnatiensis Meek. Lorraine (Ord.).
Zygospira cincinnatiensis (James) Meek, Pal. Ohio, I, 1873, p. 126, pl. 11, fig. 5.—Miller, Cincinnati Quart. Jour. Sci., II, 1875, p. 59.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 54, figs. 13, 14.
Loc. Cincinnati, Ohio.

Zygospira concentrica Ulrich. Lorraine (Ord.).
Zygospira concentrica Ulrich, Jour. Cincinnati Soc. Nat. Hist., II, 1879, p. 14, pl. 7, fig. 10.
Loc. Cincinnati, Ohio.

Zygospira deflecta Hall. Trenton (Ord.).
Atrypa deflecta Hall, Pal. New York, I, 1847, p. 140, pl. 33, fig. 4.
Zygospira deflecta Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 157.
Loc. Lewis County, New York; Ottawa, Canada.

Zygospira exigua (Hall). Trenton (Ord.).
Atrypa exigua Hall, Pal. New York, I, 1847, p. 141, pl. 33, fig. 6.
Genus? exigua Hall, Twelfth Rep. N. Y. State Cab. Nat. Hist., 1859, p. 66.
Protozyga exigua Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 149, figs. 137, 138, pl. 54, figs. 47, 48.
Loc. Lowville, Watertown, and Martinsburg, New York.

Zygospira erratica Davidson=Catazyga erratica.

Zygospira headi Hall=Catazyga headi.

Zygospira kentuckiensis James. Lorraine (Ord.).
Zygospira modesta var. kentuckiensis James, The Paleontologist, 1878, p. 7.
Zygospira kentuckiensis Nettelroth, Kentucky Fossil Shells, Mem. Kentucky Geol. Survey, 1889, p. 138, pl. 34, figs. 21–25.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 54, figs. 11, 15, 16.
Loc. Oldham and Jefferson counties, Kentucky.

Zygospira (?) mica (Billings). Anticosti (Sil.).
Rhynchonella mica Billings, Cat. Sil. Foss. Anticosti, 1866, p. 44.
Zygospira ? mica Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 157.
Loc. Division 4 of the Anticosti group, Anticosti.

Zygospira (?) minima Hall. Niagara (Sil.).
Zygospira minima Hall, Descrip. n. sp. Foss. Waldron, Indiana, 1879, p. 14;—Eleventh Rep. Indiana State Geologist, 1882, p. 305, pl. 27, fig. 7;—Trans. Albany Institute, X, 1883, p. 70.
Loc. Waldron, Indiana.

Zygospira modesta Hall. Utica and Lorraine (Ord.).
Atrypa modesta (Say) Hall, Pal. New York, I, 1847, p. 141, pl. 15, fig. 15;—Thirteenth Rep. N. Y. State Cab. Nat. Hist., 1860, p. 69.
Zygospira modesta Hall, Fifteenth Rep. N. Y. State Cab. Nat. Hist., 1862, p. 154;—Twentieth Rep. Ibidem, 1867, p. 267, figs. 1, 2.—Meek, Pal. Ohio, I, 1873, p. 125, pl. 11, fig. 4.—Miller, Cincinnati Quart. Jour. Sci., II, 1875, p. 58.—Davidson, Suppl. British Sil. Brachiopoda, Pal. Soc., 1882, p. 122.—Winchell

Zygospira modesta Hall—Continued.

and Schuchert, Minnesota Geol. Survey, III, 1893, p. 467, pl. 34, figs. 42–44.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 155, figs. 146–149, pl. 54, figs. 7–10, 12.—Keyes, Geol. Survey Missouri, V, 1895, p. 98.

Rhynchonella? modesta Billings, Geol. Canada, 1863, p. 211, fig. 211.

Loc. Cincinnati, Ohio; Turin, etc., New York; Lattners, Iowa; Spring Valley, Minnesota; Wisconsin; St. Louis County, Missouri; Ottawa, Canada (Ami).

Zygospira nicoletti Winchell and Schuchert. Trenton (Ord.).

Hallina nicoletti W. and S., American Geol., IX, April 1, 1892, p. 293;—Minnesota Geol. Survey, III, 1893, p. 474, pl. 34, figs. 59–62.

Zygospira aquila Sardeson, Bull. Minnesota Geol. Survey, III, April 9, 1892, p. 335, pl. 4, figs. 15–18.

Zygospira nicolleti Beecher and Schuchert, Biol. Soc. Washington, VIII, Pt. II, 1893, p. 71, pl. 10, fig. 23; pl. 11, figs. 11, 12.

Loc. Minneapolis, Rochester, and Fountain, Minnesota; Decorah, Iowa; Beloit, Wisconsin; Auburn, Missouri.

Zygospira paupera Billings. Anticosti (Sil.).

Zygospira paupera Billings, Cat. Sil. Fossils Anticosti, 1866, p. 46.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 157.

Loc. Division 3 of Anticosti group, Anticosti.

Zygospira putilla Hall and Clarke. ? Lorraine (Ord.).

Zygospira putilla Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 157, fig. 150, p. 365, pl. 54, figs. 35–37; pl. 83, figs. 29, 30.

Loc. Pike County, Missouri.

Zygospira recurvirostris (Hall). Trenton (Ord.).

Atrypa recurvirostris Hall, Pal. New York, I, 1847, p. 140, pl. 33, fig. 5.

Rhynchonella recurvirostris Billings, Geol. Canada, 1863, p. 168, fig. 152.

Anazyga recurvirostra Davidson, Suppl. British Sil. Brachiopoda, Pal. Soc., 1892, p. 129.

Zygospira recurvirostra Winchell and Schuchert, Minnesota Geol. Survey, III, 1893, p. 466, pl. 34, figs. 38–41.—Beecher and Schuchert, Biol. Soc. Washington, VIII, 1893, p. 71, pl. 10, figs. 7–21; pl. 11, figs. 1–10.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 54, figs. 1–6.—Whiteaves, Pal. Foss., III, Pt. III, 1897, p. 180.

Loc. New York; Kentucky; Iowa; Minnesota; Wisconsin; Ottawa, Canada; Lake Winnipeg, Manitoba. According to Billings it occurs also in the Lorraine group of Anticosti.

Zygospira saffordi Winchell and Schuchert. Trenton (Ord.).

Hallina saffordi W. and S., American Geol., IX, 1892, p. 292;—Minnesota Geol. Survey, III, 1893, p. 473, pl. 34, figs. 55–58.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1895, pl. 83, figs. 36–38.

Zygospira saffordi Beecher and Schuchert, Biol. Soc. Washington, VIII, 1893, p. 71, pl. 10, fig. 22; pl. 11, figs. 13, 13a.—Hall and Clarke, Pal. New York, VIII, Pt. II, 1893, p. 151, figs. 139–141.

Loc. Lebanon, Tennessee; Highbridge, Kentucky.

Zygospira (?) subconcava Meek and Worthen. Lower Helderberg (Dev.).

Zygospira subconcava Meek and Worthen, Geol. Survey Illinois, III, 1868, p. 380, pl. 7, fig. 1.

Loc. Perry County, Missouri.

Zygospira uphami W. and S.=Catazyga uphami.

ADVERTISEMENT.

[Bulletin 87.]

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II. Second Annual Report of the United States Geological Survey, 1880–'81, by J. W. Powell. 1882. 8°. lv, 588 pp. 62 pl. 1 map.

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IV. Fourth Annual Report of the United States Geological Survey, 1882–'83, by J. W. Powell. 1884. 8°. xxxii, 473 pp. 85 pl. and maps.

V. Fifth Annual Report of the United States Geological Survey, 1883–'84, by J. W. Powell. 1885. 8°. xxxvi, 469 pp. 58 pl. and maps.

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IX. Ninth Annual Report of the United States Geological Survey, 1887–'88, by J. W. Powell. 1889. 8°. xiii, 717 pp. 88 pl. and maps.

X. Tenth Annual Report of the United States Geological Survey, 1888–'89, by J. W. Powell. 1890. 8°. 2 pt. xv, 774 pp. 98 pl. and maps; viii, 123 pp.

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III. Geology of the Comstock Lode and the Washoe District, with atlas, by George F. Becker. 1882. 4°. xv, 422 pp. 7 pl. and atlas of 21 sheets folio. Price $11.00.

IV. Comstock Mining and Miners, by Eliot Lord. 1883. 4°. xiv, 451 pp. 3 pl. Price $1.50.

V. The Copper-Bearing Rocks of Lake Superior, by Roland Duer Irving. 1883. 4°. xvi, 464 pp. 151. 29 pl. and maps. Price $1.85.

VI. Contributions to the Knowledge of the Older Mesozoic Flora of Virginia, by William Morris Fontaine. 1883. 4°. xi, 144 pp. 54 l. 54 pl. Price $1.05.

VII. Silver-Lead Deposits of Eureka, Nevada, by Joseph Story Curtis. 1884. 4°. xiii, 200 pp. 16 pl. Price $1.20.

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The Geologic Atlas of the United States is the final form of publication of the topographic and geologic maps. The atlas is issued in parts, progressively as the surveys are extended, and is designed ultimately to cover the entire country.

Under the plan adopted the entire area of the country is divided into small quadrangular districts (designated *quadrangles*), bounded by certain meridians and parallels. The unit of survey is also the unit of publication, and the maps and descriptions of each quadrangular district are issued as a folio of the Geologic Atlas.

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No. 88

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1898

UNITED STATES GEOLOGICAL SURVEY
CHARLES D. WALCOTT, DIRECTOR

THE CRETACEOUS FORAMINIFERA OF NEW JERSEY

BY

RUFUS MATHER BAGG, JR

WASHINGTON
GOVERNMENT PRINTING OFFICE
1898

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LETTER OF TRANSMITTAL.

UNITED STATES GEOLOGICAL SURVEY,
Baltimore, Md., March 1, 1897.

SIR: I have the honor to submit herewith the manuscript of a report upon the Cretaceous Foraminifera of New Jersey, which has been prepared by Dr. R. M. Bagg as a member of my division, and I would suggest that it be published as a bulletin of the Survey.

Very respectfully,

WM. BULLOCK CLARK,
Geologist.

Hon. CHARLES D. WALCOTT,
Director United States Geological Survey.

PREFACE.

The Foraminifera described in this bulletin were collected by the author from the Greensand series of the Upper Cretaceous of New Jersey, and include representatives from the Matawan, Monmouth, Rancocas, and Manasquan formations. They were determined, described, and presented as a thesis at the Johns Hopkins University for the degree of doctor of philosophy in the year 1895, and the types are deposited in the geological museum of that university, at Baltimore, Maryland. Some additional results of later study have yielded a number of interesting forms which are here described for the first time.

The author wishes to express his gratitude to Prof. W. B. Clark, who has kindly assisted in the work, and under whose direction the investigation has been carried on.

Acknowledgments are due the following persons who have furnished material for comparative study: Dr. G. Brown Goode, of Washington; Prof. Charles W. Johnson, of the Wagner Free Institute of Science, Philadelphia; Mr. T. W. Stanton and Dr. W. H. Dall, of Washington; Prof. Alonzo Linn, of Washington and Jefferson College, Pennsylvania; and Mr. Lewis Woolman, of Philadelphia.

The writer is also under great obligation to Mr. Frederick Chapman and Charles D. Sherborn, of London, England, for their kind assistance in determining doubtful forms, and for their approval of the new species herein described.

THE CRETACEOUS FORAMINIFERA OF NEW JERSEY.

By R. M. BAGG, Jr.

INTRODUCTION.

The fossil Foraminifera of America have never received much attention, although some of the most distinguished European paleontologists have been at work upon this group for many years, and have published numerous monographs and special reports upon it. Within the last few years, however, several short papers have appeared upon the Cretaceous Foraminifera of Canada, Minnesota, New Jersey, and Alabama.

The first report upon the Cretaceous Foraminifera of Canada was published by Dr. G. M. Dawson,[1] in the Canadian Naturalist for 1874. Four species of Foraminifera are described and figured in this report, namely: *Discorbina globularis*, *Planorbulina ariminensis*, *Textularia globulosa*, and *Textularia pygmæa*. These forms were discovered in the Cretaceous rocks of Pembina, Manitoba, which bear some resemblance to the "chalk" of Nebraska.

J. B. Tyrrell[2] has recognized in the Niobrara limestone of Manitoba some 25 different species of Foraminifera, a tabulated list of which appeared in the Transactions of the Royal Society of Canada and in the Annual Report of the Geological Survey of Canada[3] for 1890 and 1891.

Sixteen species of Foraminifera from the Cretaceous bowlder clays of central Minnesota were described and figured by Woodward and Thomas[4] in 1885. This report was reprinted, with additions of fossils from Nebraska and Illinois, in the Final Report of the Geological Survey of Minnesota.[5]

[1] Note on the occurrence of Foraminifera, coccoliths, and rhabdoliths in the Cretaceous rocks of Manitoba: Canadian Naturalist, new series, Vol. VII, 1874, pp. 252–257.

[2] Foraminifera and Radiolaria from the Cretaceous of Manitoba: Trans. Royal Soc. Canada, Vol. VIII, 1890, sec. 4, pp. 111–115.

[3] Geol. Surv. Canada, Rept. 1890–91, Vol. V, pt. 1, p. 211.

[4] On the Foraminifera of the bowlder clay taken from a well shaft 22 feet deep, Meeker County, central Minnesota: Geol. Nat. Hist. Surv. Minnesota, Thirteenth Ann. Rept., for 1884, pp. 164–177, Pls. I–III.

[5] Final Rept. Geol. Nat. Hist. Surv. Minnesota, Vol. III, 1893, pp. 23–54, Pls. C–E.

The Journal of the New York Microscopical Society for April, 1890,[1] contains a short article on the Cretaceous Foraminifera of New Jersey, by Dr. Anthony Woodward. This paper is entitled Synopsis of the Cretaceous Foraminifera of New Jersey, and contains only a review of previous investigations. A second part, however, appeared in the same journal for 1894,[2] in which Dr. Woodward describes 58 different species of Foraminifera from the New Jersey marl beds.

Still more recently a tabulated list of the Cretaceous and Tertiary Foraminifera of Alabama has been published in a special report of the Geological Survey of Alabama.[3]

The present memoir is a more thorough account than has previously been given of the Cretaceous Foraminifera from the marl beds of New Jersey. It was presented as a thesis at the Johns Hopkins University in May, 1895, but has been somewhat revised and enlarged, and contains descriptions of a number of species from the upper beds of the Matawan formation, which are here given for the first time. The latter were collected by the author during the last summer, while he was engaged in geological mapping in southern New Jersey. The specimens were obtained at Marshalltown, Salem County, New Jersey, in a very fossiliferous bed of sandy marl, which has been dug as a fertilizer.

A large amount of material has been collected and examined in the preparation of this report, from the following localities:

Monmouth formation (Navesink division, or lower marl bed): Atlantic Highlands, Freehold, and Cream Ridge.

Rancocas formation (middle marl bed): Blue Ball, New Egypt, Vincentown, Swedesboro, Timber Creek, and Harrisonville; also from a well boring at Quinton.

Manasquan formation (upper marl bed, lower part): Vincentown.

It was hoped that a careful study of the Foraminifera found in these various marl beds might not only result in the addition of many new species to our American Cretaceous, but might also serve as a means of identification of these strata. Such has been found to be the case, although the fact that certain species are present in several or all the beds has been established, while many of them have continued through deposits of later age and are found in existing oceans.[4]

The writer believes that the localities from which the fossils were collected for study are as typical as any which might have been chosen, although further investigation in many new localities can hardly fail to yield additional results.

The excellent state of preservation and the large size of many of the species are most striking and bear witness to the favorable conditions for their existence in the late Cretaceous sea.

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[1] Cretaceous Foraminifera of New Jersey, Part I: Jour. N. Y. Microa. Soc., Vol. VI, No. 2, April, 1890, pp. 45–55.

[2] Ibid., Part 2, Vol. X, No. 4, Oct., 1894, pp. 91–141.

[3] Geol. Surv. Alabama, Rept. Geology Coastal Plain, 1894, pp. 93, 249, 285, 286, 288, 289.

[4] For geological distribution of these forms see tabular review, pp. 69–71.

Specimens of three types have been analyzed, two of calcareous and one of arenaceous character, in order to determine the amount of silica which is present. The analyses were made by Mr. W. F. Hillebrand, and the results are as follows:

No. 1. *Verneuilina triquetra* (von Münster).

	Per cent.
Silica	38.3
Additional insoluble matter	3.07
Total insoluble matter	41.37

This is an arenaceous-siliceous type, and the large amount of silica present is in the form of polished sand grains, with scattered grains of glauconite, which have been firmly cemented together.

No. 2. *Flabellina sagittaria* (Lea).

	Per cent.
Silica	1.2
Additional insoluble matter	0.55
Total insoluble matter	1.75

The base of the additional insoluble matter consisted of alumina and magnesia, together with a trace of iron and probably alkalies.

No. 3. *Nodosaria consobrina*, var. *emaciata* (Reuss).

	Per cent.
Silica	1.8

It is an interesting fact bearing on the origin of greensand that the writer has frequently found shells of Foraminifera filled with glauconite. This has been especially noticeable in *Polymorphina communis*, which in some cases, where the shell is broken away, shows the interior filled with light-green glauconite still bearing upon its outer surface the smooth impress of the shell.

Many Cristellariæ are partially filled with a light-brown clay suggesting the early stage in the formation of the glauconite grain. Upon a few grains of glauconite I have found clinging to the central portion remnants of the original shell, while the glauconite still shows an internal cast of the shell.

It is perhaps rather remarkable that among so many grains of glauconite so few perfect casts of Foraminifera are found and so small a number of intermediate stages, but it must be remembered that the shell wall of the forms is always thin and easily destroyed through solution in the percolating waters in such porous beds. Even among the Lamellibranchiata and Gasteropoda casts of the shells are much more abundant than well-preserved shells, except the heavier, ponderous shells of *Exogyra costata* and *Gryphæa vesicularis*. From the size of the glauconite grains and the peculiarity of their shape it is probable that the glauconite has grown by accretion around an original nucleus, so that the outline of the delicate shells is only exceptionally preserved.

Transverse sections of the glauconite grains show a difference in color and texture between the internal and external parts, the inner

portion being of a light olive-green and softer than the dark-green irregular border.

Several analyses of New Jersey glauconite have been made from carefully selected grains; one made by T. Sterry Hunt is as follows:[1]

Analysis of selected grains of New Jersey glauconite.

SiO_2	50.70	K_2O	5.80
FeO	22.50	Na_2O	0.75
MgO	2.16	H_2O	8.95
CaO	1.11		100.00
Al_2O_3	8.03		

It is not the object of this paper to enter into any discussion of the much-disputed problem of the origin of greensand. This subject has been discussed by numerous writers, especially of late by Murray and Renard[2] in their report upon the deep-sea deposits obtained by the *Challenger* Expedition. A statement of the results brought out by this investigation, with a short review of former theories, has been published by Prof. W. B. Clark[3] in his discussion of the origin of the greensand of New Jersey. That both organic and inorganic materials must be present for the formation of greensand has been established, but just what proportion of each is necessary is not so readily determined. The inorganic material occurring in the New Jersey marl beds is chiefly quartz and mica, and is supposed to have been derived from the crystalline rocks of Pennsylvania and northern New Jersey.

The greensands differ in the size of the sand grains, in the amount of rounding, and in the proportion of sand to glauconite. In the Manasquan formation (lower part of upper marl bed) there is proportionately more glauconite than in any of the other beds, while the quartz grains are more rounded than in the lower beds of the Monmouth formation, though perhaps less so in the upper or Redbank series. So large an amount of quartz sand is present in this latter bed that glauconite holds only a secondary place. For this reason no Foraminifera are known from the Redbank sands, although it is probable that the upper and lower portions of the bed will furnish some when more thoroughly examined.

The Navesink marls contain more Foraminifera than the Manasquan beds, and in a somewhat better state of preservation, but it is in the limestone layer of the Rancocas formation (middle marl bed) that the greatest abundance of forms is found. This deposit, frequently consolidated, is made up of great quantities of bryozoan shells and vast numbers of perfectly preserved Foraminifera. Seventy-nine species have been determined from this horizon alone. Four species are present in all four marl beds, namely: *Nodosaria obliqua* (Linné), *Nodosaria polygona* Reuss, *Nodosaria zippei* Reuss, and *Truncatulina lobatula* (Walker and Jacob).

[1] Mineral Physiology and Physiography, 1886, p. 198.

[2] Reports *Challenger* Expedition; Deep-sea deposits, 1892.

[3] *A preliminary* report on the Cretaceous and Tertiary formations of New Jersey: Report of the *State Geologist of* New Jersey for 1892, pp. 167–246.

HISTORICAL SUMMARY.

The value of the greensand marls for fertilizing purposes has been known in New Jersey for more than a century. In 1768 a laborer, while digging a ditch in a meadow near Marlboro, threw out a substance which was pronounced to be *marl*. Some of this marl was spread upon the land with good results, but no particular attention seems to have been paid to the discovery until the year 1811, when its value began to be appreciated.

The discovery of fossils in the marl beds was made soon after, and in 1820 some of these fossils were described by Say,[1] and others by Morton[2] in 1829.

The first mention of Foraminifera was made by Isaac Lea[3] in 1833, in his Contributions to Geology, when he described *Flabellina sagittaria* as *Palmula sagittaria* from the Cretaceous deposit of Timber Creek, New Jersey, in which he considered the form a new genus of the family Spherulacea of Blainville. The genus Palmula Mr. Lea considered as intermediate between the genus Saracenaria of Defrance and the genus Textularia of the same author. This same species was described by Dr. S. G. Morton[4] in 1842 as *Planularia cuneata*.

In the American Journal of Science for 1841[5] Prof. J. W. Bailey gives a brief note on the discovery of fossil Foraminifera in New Jersey, and states that "a large portion of the calcareous rock defined by Prof. H. D. Rogers[6] as the third formation of the upper secondary is made up of great quantities of microscopic shells belonging to the Foraminifera."

Sir Charles Lyell,[7] on his visit to America in the year 1841, noticed the occurrence of Foraminifera in the Cretaceous marl beds of New Jersey, and mentioned three very common types, Cristellaria, Rotalia (Rotalina), and Nodosaria.

In his Origin of Greensand, and its Formation in the Oceans of the Present Epoch,[8] Prof. J. W. Bailey refers to the deposits at Mullica Hill and Mount Holly, New Jersey, as being very rich in greensand casts of Polythalamia.

Mr. W. M. Gabb, in Descriptions of New Species of American Tertiary and Cretaceous Fossils,[9] describes one of the Nodosariæ from Mullica Hill as a new species under the name *Dentalina pulchra*, but which is known to be *Nodosaria zippei* Reuss.

The first report of any importance upon the determination of these

[1] Am. Jour. Sci., 1st series, Vol. II, 1820, pp. 34–45.
[2] Jour. Acad. Nat. Sci. Philadelphia, Vol. VI, 1829, pp. 120–129.
[3] Contributions to Geology, 1833, pp. 219–220, Pl. VI, fig. 228.
[4] Jour. Acad. Nat. Sci. Philadelphia, Vol. VIII, 1842, pp. 214–215, Pl. XI, fig. 5.
[5] Am. Jour. Sci., 1st series, Vol. XLI, 1841, pp. 213–214.
[6] Report of the Geol. Surv. of the State of New Jersey, 1836, pp. 10–13.
[7] Quart. Jour. Geol. Soc. London, Vol. I, 1845, pp. 56, 57, and 64. See, also, Travels in North America, I, 1845, p. 64.
[8] Proc. Boston Soc. Nat. Hist., Vol. V, 1856, pp. 365, 366.
[9] Jour. Acad. Nat. Sci. Philadelphia, new series, Vol, IV, 1860, pp. 375–406, Pl. LXIX.

microscopic organisms was published in 1861 by Prof. A. E. Reuss,[1] one of the most distinguished of European paleontologists. In this article, entitled Die Foraminiferen der senonischen Gründsandes von New Jersey, Professor Reuss described some 28 different species of Foraminifera, but mentioned neither the horizon nor the localities from which they were obtained. While a few of these forms were figured in this report, the majority are given in other works.

Hermann von Credner[2] in 1870 published an article entitled Die Kreide von New Jersey, which contained a general review of the Cretaceous of New Jersey. In this report two Foraminifera from the Bryozoa bed at Brownville, *Flabellina cordata* Reuss and *Nodosaria sulcata* Nilsson, are described.

Subsequent to Professor Credner's report in 1870 no work was done upon the Foraminifera of New Jersey until the year 1894, when Dr. Woodward[3] published the second part of his Cretaceous Foraminifera of New Jersey. In this report some 58 species of Foraminifera from Timber Creek, Mullica Hill, New Egypt, and Bruere's pits, on Crosswicks Creek, are described but not figured.

The material investigated at the geological laboratory of the Johns Hopkins University has furnished nearly twice as many species as previously reported, and six of these are considered to be new. A preliminary report of this investigation, containing a description of the new forms and a tabulated list of other species identified, was published by the author[4] in 1895.

The Foraminifera described in this bulletin are deposited in the geological museum at the Johns Hopkins University, Baltimore, Maryland.

CLASSIFICATION OF STRATA.

The classification of the marl beds adopted in this report is one employed by Prof. W. B. Clark in his report, lately published, upon the Upper Cretaceous formations of New Jersey, Delaware, and Maryland,[5] viz:

Age.	*Formation.*		
Eocene	Shark River		Upper marl bed.
Upper Cretaceous	Manasquan		
	Rancocas	Vincentown lime sands	Middle marl bed.
		Sewell marls	
	Monmouth	Redbank sands	Red sand and lower marl bed.
		Navesink marls	
		Mount Laurel sands	
	Matawan	Hazlet sands	Clay marls.
		Crosswicks clays	

[1] Sits. Akad. Wiss. Wien, Vol. XLIV, pt. i, 1861, pp. 334–342, plates.
[2] Zeitsch. d. D. geol. Gesell., 1870, Vol. XXII, pp. 191–251.
[3] Jour. N. Y. Micros. Soc., Vol. X, No. 4, Oct., 1894, pp. 91–141.
[4] Johns Hopkins Univ. Circulars, No. 121, Oct., 1895.
[5] Bull. Geol. Soc. America, vol. 8, pp. 315–358, pls. 40–50.

BIBLIOGRAPHY.

Within the last ten years several bibliographies of the Foraminifera have appeared, which have been of invaluable assistance in the preparation of this report. The best bibliography which has yet been published is that of Prof. Charles D. Sherborn, entitled A Bibliography of the Foraminifera, Recent and Fossil, from 1565 to 1888. (London, 1888.) This excellent catalogue is based upon the bibliography given by Prof. H. B. Brady in the *Challenger* report, but has been greatly enlarged and revised.

Another bibliography, less exhaustive, compiled by Dr. Anthony Woodward, was published in the Fourteenth Annual Report of the Geological and Natural History Survey of Minnesota for the year 1885.

There has lately been published in the Smithsonian Miscellaneous Collections An Index to the Genera and Species of the Foraminifera, by Charles D. Sherborn. This exhaustive work, invaluable to all students of Foraminifera, is in two parts, and forms a portion of Volume XXXVII of the Smithsonian reports. The first part was published in November, 1893, and included all names from A to N, while the second portion, published in 1896, completes the alphabetic list of forms from N to Z. The most distinguished specialists in the Foraminifera have been consulted by Professor Sherborn in the preparation of this laborious work, and too much praise can not be given the author for the completeness and accuracy of its contents.

The following is a list of works consulted in the preparation of this report. No attempt is made to give a complete bibliography; only those publications which have been most useful are included:

AGASSIZ, Alexander. On the Explorations in the Vicinity of the Tortugas during March and April, 1881 (Pelagic Fauna of the Gulf Stream).

Bull. Mus. Comp. Zool., Harvard, Vol. IX, 1881, pp. 145–149.

—— A Contribution to American Thalassography.

Bull. Mus. Comp. Zool., Harvard, Vols. XIV, XV, 1888, and 2 vols., 8°, London, 1888.

ALTH, Alojzy. Geognostisch-paläontologische Beschreibung der nächsten Umgebung von Lemberg.

Haidinger's Naturw. Abhandl., Vol. III, Abth. 2, 1850, pp. 171–284, Pls. IX–XIII (pp. 262–271, Pl. XIII).

ANDREAE, A. Ein Beitrag zur Kenntniss des Elsässer Tertiärs.

Abhandl. Geol. Special-Karte Elsass-Lothringen, Vol. II, Heft 3. 1884, 331 pp., Pls. I–XII.

ANSTED, David Thomas. The Deposits of the North Atlantic in Deep Water, and their Relation to the White Chalk of the Cretaceous Period.

Pop. Science Review, Vol. IX, 1870, pp. 24–33, Pl. LV.

BAILEY, Jacob Whitman. Note on the Discovery of "Fossil Foraminifera in the Green Sand of New Jersey."

Am. Jour. Sci., ser. 1, Vol. XLI, 1841, pp. 213–214.

—— American Polythalamia from the Upper Mississippi, and also from the Cretaceous Formation of the Upper Missouri.

Am. Jour. Sci., ser. 1, Vol. XLI, 1841, pp. 400–401; 4 woodcuts.

—— On Fossil Foraminifera in the Calcareous Marl from the Cretaceous Formation on the Upper Missouri.

Proc. Acad. Nat. Sci., Philadelphia, Vol. I, 1843, p. 75.

—— Microscopical Examination of Soundings made by the U. S. Coast Survey off the Atlantic Coast of the United States.

Smithsonian Contributions, Vol. II, 1851, art. 3, pp. 1–15; plate. Reprinted in Rept. U. S. Coast Survey for 1855 (1856), p. 360.

—— Silicified Polythalamia in Florida.

Am. Jour. Sci., ser. 2, Vol. II, 1851, p. 86.

—— On the Origin of Greensand and its Formation in the Oceans of the Present Epoch.

Proc. Boston Soc. Nat. Hist. Vol. V, 1856, pp. 364–368. Am. Jour. Sci., ser. 2, Vol. XXII, 1856, pp. 280–284. Quart. Jour. Microsc. Science, Vol. V, 1857, pp. 83–87.

BEISSEL, Ignaz. Die Foraminiferen der Aachener Kreide.

Abhandl. geol. Specialkarte von Preussen und d. Thüringischen Staaten, Neue Folge, Heft 3, 1891, Pls. I–XVI.

BERTHELIN, Georges. Mémoire sur les foraminifères fossiles de l'étage Albien de Moncley (Doubs).

Mém. Soc. Géol. France, ser. 3, Vol. I, No. 5, 1880, pp. 1–84, Pls. XXIV–XXVII.

BORNEMANN, Johann Georg. Die microscopische Fauna des Septarienthones von Hermsdorf bei Berlin.

Zeitsch. d. D. geol. Gesell, Vol. VII, 1855, pp. 307–371, Pls. XII–XXI.

BRADY, Henry Bowman. Report on the Foraminifera dredged by H. M. S. *Challenger* during the years 1873–1876.

Reports of the Scientific Results of the Voyage of H. M. S. *Challenger*, Vol. IX, (Zoology), 1884, pp. 814, figures and volume of 115 plates.

—— PARKER, W. K., and JONES, T. R. A Monograph on the Genus Polymorphina.

Trans. Linn. Soc., London, Vol. XXVII, 1870, pp. 197–253, Pls. XXXIX–XLII, and figures in text.

BRONN, Heinrich Georg. Lethaea Geognostica, Ed. 3, 1851–1856.

Vol. I, Theil I, pp. 106–109; Vol. II, Theil V, pp. 81–96, Pls. XXIX, XXXIII, XLII; Vol. III, Theil VI, pp. 197–255, Pls. XXXV^2, XXXV^3, XLII.

—— Die Klassen und Ordnungen des Thier-Reichs, wissenschaftlich dargestellt in Wort und Bild.

Band I, Amorphozoen, 1859, pp. 45–81, Pls. V–VII.

BURROWS, H. W., SHERBORN, C. D., and BAILEY, George. The Foraminifera of the Red Chalk.

Jour. Royal Microsc. Soc., London, ser. 2, Vol. VIII, 1888, pp. 383–385.

—— —— —— The Foraminifera of the Red Chalk of Yorkshire, Norfolk, and Lincolnshire.

Jour. Royal Microsc. Soc., London, 1890, pp. 549–564, Pls. VIII–XI.

CARPENTER, William Benjamin. On the Systematic Arrangement of the Foraminifera.

Nat. Hist. Review, Vol. I, 1861, pp. 456–472.

—— PARKER, W. K., and JONES, T. R. Introduction to the Study of the Foraminifera.

Ray Society, London, 1862, 319 pp., 22 plates.

CHAPMAN, Frederick. Some new forms of Hyaline Foraminifera from the Gault.

Geol. Mag., Decade III, n. s., Vol. IX, 1892, no. 11, pp. 52–54, Pl. II.

—— The Foraminifera of the Gault of Folkstone.

Jour. Royal Micros. Soc. London, 1891, Part 1, pp. 565–575, Pl. IX; Ibid, 1892, Part II, pp. 319–330, Pls. V, VI; Ibid, 1892, Part III, pp. 749–758, Pls. XI, XII; Ibid, 1893, Part IV, pp. 579–595, Pls. VIII–IX.

—— Microzoa from the Phosphatic Chalk of Taplow.

Quart. Jour. Geol. Soc. London, 1892, pp. 514–518, Pl. XV.

—— On a Phosphatic Chalk with *Holaster planus* at Lewes. (By A. Strahan.) Appendix by F. Chapman. The Foraminifera and Ostracoda.

Quart. Jour. Geol. Soc. London, Vol. LII, 1896, pp. 470–472.

—— On the Rhizopodal Genera Webbina and Vitrewebbina.

Ann. and Mag. Nat. Hist., ser. 6, Vol. XVIII, 1896, pp. 326–333; figures.

CONRAD, Timothy Abbot. Description of New Species of Organic Remains from the Upper Eocene Limestone of Tampa Bay.

Am. Jour. Sci., ser. 2, Vol. II, 1846, pp. 399–400.

—— Check List of the Invertebrate Fossils of North America. Eocene and Oligocene.

Smithsonian Misc. Coll., Vol. VII, 1866, No. 200, pp. 1–34.

CORNUEL, J. Description de nouveaux fossiles microscopiques du terrain crétacé inférieur du département de la Haute-Marne.

Mém. Soc. Géol. France, ser. 2, Vol. III, 1848, pp. 241–263, Pls. III, IV.

CREDNER, Hermann. Die Kreide von New Jersey.

Zeitsch. d. D. geol. Gesell., Vol. XXII, 1870, pp. 191–251; plate.

DAWSON, George Mercer. On the Occurrence of Foraminifera, Coccoliths, and Rhabdoliths in the Cretaceous Rocks of Manitoba.

Canad. Nat., n. s., Vol. VII, 1874, pp. 252–257; figures.

DAWSON, George Mercer. On the Microscopic Structure of Certain Boulder Clays, and the Organisms contained in them.

Thirteenth Ann. Rept. Geol. and Nat. Hist. Sur. Minn. for 1884 (1885), pp. 150-163.

DAWSON, John William. Notice of Tertiary Fossils from Labrador, Maine, etc.

Canad. Nat, Vol. V, 1860, pp. 188–200; figures.

—— On some New Species of Fossil Protozoa from Canada.

Proc. Am. Assoc. Adv. Sci., Vol. XXIV, 1876, pp. 100–106; figures.

EGGER, Johann Georg. Die Foraminiferen der Miocän-Schichten bei Ortenburg in Nieder-Bayern.

Neues Jahrb. f. Min., etc., 1857, pp. 266–311, Pls. V–XV.

EHRENBERG, Christian Gottfried. Ueber die Bildung der Kreidefelsen und des Kreidemergels durch unsichtbare Organismen.

Abhandl. königl. Akad. Wiss. Berlin for 1838, 1839, pp. 59–147, Pls. I–IV.

—— Verbreitung und Einfluss des microscopischen Lebens in Süd- und Nord-Amerika.

Abhandl. k. Akad. Wiss. Berlin for 1841, 1843, pp. 291–446, Pls. I–IV.

—— Ueber das mikroscopische Leben in Texas.

Bericht k. preuss. Akad. Wiss. Berlin, 1849, pp. 87–91.

—— Mikrogeologie, 2 vols., 1854; 40 plates.

See PARKER, W. K., et al., Ann. Mag. Nat. Hist., Vols. IX, X, 1872.

ENGELMANN, Wilhelm. Bibliotheca Historico-Naturalis, 1846.

Section Protozoa.

GABB, William M. Catalogue of the Invertebrate Fossils of the United States, with References.

Issued as a separate publication of the Proceedings Acad. Nat. Sci. Philadelphia for 1859 (1860), pp. 1–20.

—— Descriptions of New Species of American Tertiary and Cretaceous Fossils.

Jour. Acad. Nat. Sci. Philadelphia, n. s., Vol. IV, 1860, pp. 375–406.

—— and HORN, G. H. Monograph of the Fossil Polyzoa of the Secondary and Tertiary Formations of North America.

Jour. Acad. Nat. Sci. Philadelphia, n. s., Vol. V, pt. 2, 1862, p. 179, Pl. XXI, fig. 71.

GEINITZ, Hans Bruno. Characteristik der Schichten und Petrefaction des Sächsisch-böhmischen Kreidegebirges; second edition, 1850.

HEILPRIN, Angelo. Notes on Some New Foraminifera from the Nummulitic Formation of Florida.

Proc. Acad. Nat. Sci. Philadelphia, 1884, pp. 321–332; figures.

JOHNSON, H. A., and THOMAS, B. W. Report of the Committee on the Microscopic Organisms in the Boulder Clays of Chicago and Vicinity.

Bull. Chicago Acad. Sci., Vol. I, No. 4, 1884, pp. 35–40; figures.

JONES, Thomas Rupert. Remarks on the Foraminifera, with Especial Reference to their Variability of Form, illustrated by the Cristellarians.

Monthly Microsc. Jour., Vol. XV, 1876, pp. 61–92, Pls. CXXVIII, CXXIX.

—— and PARKER, W. K. On the Foraminifera of the Family Rotalinæ (Carpenter) found in the Cretaceous Formation, with Notes on their Tertiary and Recent Representatives.

Quart. Jour. Geol. Soc. London, Vol. XXVIII, 1872, pp. 103–131.

—— —— and BRADY H. B. A Monograph on the Foraminifera of the Crag. Part I.

Paleontographical Soc., Vol. XIX, 1866, pp. 1–72, Pls. I–IV.

—— and SHERBORN, C. D. Remarks on the Foraminifera, with Especial Reference to their Variability of Form, illustrated by the Cristellarians; Part II.

Jour. Royal Microsc. Soc. London, ser. 2, Vol. VII, 1887, pp. 545–557.

JUKES-BROWNE, A. J. The Origin of Greensand.

Science Gossip, 1876, pp. 30, 170.

KARRER, Felix. Ueber ein Vorkommen von oberer Kreideformation in Leitzersdorf bei Stockerau, und deren Foraminiferenfauna.

Jahrb. k. k. geol. Reichsanst., Vol. XX, 1870, pp. 157–184, Pls. X, XI.

LEA, Isaac. Contributions to Geology, 1833, pp. 227, Pls. I–VI.

LEIDY, Joseph. Foraminifera of the Coast of New Jersey.

Proc. Acad. Nat. Sci. Philadelphia, 1878, p. 292.

LYELL, Charles. Notice of the Foraminifera of the Cretaceous Beds of New Jersey.

Quart. Jour. Geol. Soc. London, Vol. I, 1845, pp. 55–60; figures.

MEEK, Fielding Bradford. Check List of the Invertebrate Fossils of North America; Cretaceous Formation.

Smithsonian Mis. Col., Vol. VII, 1864, No. 177, pp. 26.

—— Synopsis of the Invertebrate Fossils of the Cretaceous Formation of New Jersey.

Appendix A, Geology of New Jersey, 1868, p. 721.

MORTON, Samuel G. Synopsis of the Organic Remains of the Cretaceous Group, 1834; Plates.

—— Description of Some New Species of Organic Remains of the Cretaceous Group of the United States; with a Tabular Review of the Fossils hitherto discovered in this Formation.

Jour. Acad. Nat. Sci. Philadelphia, Vol. VIII, pt. 2, 1842, pp. 207–227, Pls. X, XI.

D'ORBIGNY, Alcide Dessalines. Tableau méthodique de la classe des céphalopodes.

Annales Sci. Nat., Vol. VII, 1826, pp. 245–314, Pls. X–XVII.

—— Voyage dans l'Amérique Méridionale—Foraminifères.

Vol. V, *pt. 5, 1839, pp. 1–86,* Pls. I–IX.

D'ORBIGNY, Alcide Dessalines. Mémoire sur les foraminifères de la craie blanche du bassin de Paris.

Mém. Soc. Géol. France, Vol. IV, 1840, pp. 1–51, Pls. I–IV.

—— Foraminifères fossiles du bassin tertiaire de Vienne, Pls. I–XXI.

PARKER, W. K., and JONES, T. R. On Some Foraminifera from the North Atlantic and Arctic Oceans, including Davis Straits and Baffin's Bay.

Phil. Trans. (1864), 1865, pp. 321–441, Pls. XII–XIX.

—— —— Description of Some Foraminifera from the Coast of Norway.

Ann. and Mag. Nat. Hist., ser. 2, Vol. XIX, 1857, pp. 273–303, Pls. X, XI.

—— —— BRADY, H. B, and KIRKBY, J. W. On the Nomenclature of the Foraminifera.

Ann. and Mag. Nat. Hist., 1859–1872, ser. 3, Vol. III, to ser. 4, Vol. X.

POURTALES, L. F. de. On the Distribution of the Foraminifera on the Coast of New Jersey, as shown by the Off-shore Soundings of the Coast Survey.

Proc. Am. Assoc. Adv. Sci., Vol. III, 1850, pp. 84–88.

—— The Gulf Stream. Characteristics of the Atlantic Sea-bottom off the Coast of the United States.

Rept. Supt. U. S. Coast Survey for 1869 (1872), pp. 220–225.

REUSS, Aguste E. In H. B. Geinitz, Grundriss der Versteinerungskunde, 1845–46, pp. 635–686, Pl. XXIV.

—— Die Versteinerungen der böhmischen Kreideformation, 1845–46; Plates.

—— Neue Foraminiferen aus den Schichten des österreichischen Tertiärsbeckens.

Denks. Akad. Wiss. Wien, Vol. I, 1850, pp. 365–390, Pls. XLVI–LI.

—— Die Foraminiferen und Entomostraceen des Kreidemergels von Lemberg.

Haidinger's Nat. Abhandl., Vol. IV, 1851, pp. 17–52, Pls. I–V. (Referred to as Pls. II–VI.)

—— Ueber die fossilen Foraminiferen und Entomostraceen der Septarienthone der Umgegend von Berlin.

Zeits. d. D. Geol. Gesell., Vol. III, 1851, pp. 49–92, Pls. III–VII.

—— Beiträge zur Charakteristik der Kreideschichten in den Ostalpen besonders im Gosanthale und am Wolfgangsee.

Denks. Akad. Wiss. Wien, Vol. VII, Abth. 1, 1854, pp. 156, Pls. 31.

—— Beiträge zur Charakteristik der Tertiärschichten des nördlichen und mittleren Deutschlands.

Sitz. Akad. Wiss. Wien, Vol. XVIII, 1855, pp. 197–272, Pls. I–XII.

—— Ein Beitrag zur genauren Kenntniss der Kreidegebilde Mecklenburgs.

Zeits. d. D. geol. Gesell., Vol. VII, 1855, pp. 261–292, Pls. VIII, IX.

REUSS, Aguste E. Die marinen Tertiärschichten Böhmens und ihre Versteinerungen.

Sitz. Akad. Wiss. Wien, Vol. XXXIX, 1860, pp. 207–284, Pls. I–VIII (Pl. III).

—— Die Foraminiferen der Westphälischen Kreideformation.

Sitz. Akad. Wiss. Wien, Vol. XL, 1860, pp. 147–238, Pls. I–XIII.

—— Beiträge zur tertiären Foraminiferen-Fauna. I. Die Foraminiferen des Crag's von Antwerpen (pp. 355–364). II. Die Foraminiferen von Dingden in Westphalen (pp. 364–370).

Sitz. Akad. Wiss. Wien, Vol. XLII, 1860, Pls. I, II (see 1864).

—— Die Foraminiferen des senonischen Grünsandes von New Jersey.

Sitz. Akad. Wiss. Wien, Vol. XLIV, Abth. 1, 1861, pp. 334–340, Pls. I–VIII.

—— Die Foraminiferen des nord-deutschen Hils und Gault.

Sitz. Akad. Wiss. Wien, Vol. XLVI, Abth. 1, 1862 (1863), pp. 5–100, Pls. I–XIII.

—— Beiträge zur Kenntniss der tertiären Foraminiferenfauna.

Sitz. Akad. Wiss. Wien, Vol. XLVIII, Abth. 1, 1863, pp. 36–69, Pls. I–VIII.

—— Zur Fauna des deutschen Ober-Oligocäns, I Abth.

Sitz. Akad. Wiss. Wien, Vol. L, Abth. 1, 1864 (1865), pp. 435–482, Pls. I–V.

—— Die Foraminiferen und Ostrakoden der Kreide am Kanara-See bei Küstendische.

Sitz. Akad. Wiss. Wien, Vol. LII, Abth. 1, 1865 (1866), pt. 1, pp. 445–470, Plate.

—— Die Foraminiferen, Anthozoen, und Bryozoen des deutschen Septarienthones.

Denks. Akad. Wiss. Wien, Vol. XXV, 1865, pp. 117–204, Pls. I–XI.

—— Die Bryozoen und Foraminiferen des unteren Quaders.

Palæontographica, Vol. XX, pt. 1, 1871–1875, pp. 97–142, Pls. XXIV–XXXIII.

ROEMER, Ferdinand. Die Kreidebildungen von Texas, 1852, p. 86, Pl. X, fig. 7.

ROEMER, Friedrich Adolph. Die Versteinerungen des norddeutsches Kreidegebirges, 1840–41, pp. 145, Pls. I–XVI (Pl. XV). Neue Kreide-Foraminiferen.

Neues Jahrb. f. Min., etc., 1842, pp. 272, 273, Pl. VII B.

SCHWAGER, Conrad. Saggio di una classificazione dei Foraminiferi avuto riguardo alle loro famiglie naturali.

Boll. R. Com. Geol. Ital., 1876, pp. 475–485; 1877, pp. 18–24; plate.

SCIENCE GOSSIP, 1870. Recent Foraminifera, pp. 9–12, figs. 17–31; Chalk Foraminifera, pp. 81–83, figs. 75–94; d'Orbigny's Foraminifera, pp. 106–108, figs. 103–119; d'Orbigny's Foraminifera, pp. 155–157, figs. 138–156.

SEGUENZA, G. Studi geologici e paleontologici sul cretaceo medio dell' Italia meridionale.

Atti R. Accad. Lincei., ser. 3, Vol. XII, 1879, pp. 65-214, Pls. I–XXI.

SHERBORN, C. D. A Bibliography of the Foraminifera, Recent and Fossil, from 1565 to 1888. London, 1888.

—— An Index to the Genera and Species of the Foraminifera.

Part I, A–Non. Smithsonian Misc. Coll. No. 856, 1893. Part II, Non–Z. Smithsonian Misc. Coll. No. 1031, 1896. Part of Vol. XXXVII, not yet published.

—— and CHAPMAN, F. On Some Microzoa from the London Clay exposed in the Drainage Works. Piccadilly, London, 1885.

Jour. Royal Microsc. Soc., ser. 2, Vol. VI, 1886, pp. 737–764, Pls. I–III.

SOLLAS, W. J. On the Perforate Character of the Genus Webbina, etc.

Geol. Mag., Decade II, Vol. IV, No. 3, March, 1877, pp. 102–105, Pl. VI.

TASCHENBERG, O. Bibliotheca Zoologica II, Third Lief., 1887. Protozoa, pp. 880–925.

TERSUEM, Olry. Les foraminifères de l'Eocène des environs de Paris.

Mém. Soc. Géol. France, ser. 3. Vol. II, Mém. 3, 1882, pp. 193, Pls. IX–XXVIII.

VERRILL, A. E. Characters of the Deep-sea Deposits of the Eastern American Coasts.

Amer. Nat., Vol. XIX, 1885, pp. 69, 70.

WHITE, C. A. Bibliography of North American Invertebrate Palæontology, 1878, pp. 132.

WILLIAMSON, William Crawford. On the Recent Foraminifera of Great Britain. Ray Society, 1858; plates.

WOODWARD, Anthony. A Bibliography of the Foraminifera, Recent and Fossil, including Eozoön and Receptaculites, 1565–1886.

Fourteenth Ann. Rept. Geol. Nat. Hist. Surv. Minn. for 1885, pp. 167–311, 1886.

—— Cretaceous Foraminifera of New Jersey, Part I.

Jour. N. Y. Micr. Soc., Vol. VI, No. 2, Apr., 1890, pp. 45–55.

—— Cretaceous Foraminifera of New Jersey, Part II.

Jour. N. Y. Micr. Soc., Vol. X, No. 4, Oct., 1894, pp. 91–141.

—— Foraminifera found in the Alabama Chalk.

Geol. Surv. Ala., Report of Geol. Coastal Plain, 1894, p. 289.

—— and THOMAS, B. W. On the Foraminifera of the Boulder Clay taken from a Well Shaft 22 feet deep, Meeker County, Central Minnesota.

Thirteenth Ann. Rept. Geol. and Nat. Hist. Surv. Minn. for 1884, pp. 164–177, Pls. III, IV.

—— —— The Microscopical Fauna of the Cretaceous in Minnesota, with Additions from Nebraska and Illinois.

Final Rept. Minn. Geol. and Nat. Hist. Surv. Vol. III, 1893, pp. 23–51, Pls. C–E.

WOOLMAN, Lewis. Microsc. Bull. Queen & Co., Vol. V, No. 6, 1888, p. 41.

ZITTEL, Karl A. von. Handbuch der Palæontologie, 1876–1880, Band I, Abth. 1, pp. 61–114; pp. 723–732.

DESCRIPTIVE TERMS.

The following descriptive terms, adopted in this memoir, are taken, with some modification, from the report on the Recent Foraminifera of Great Britain, by Prof. W. C. Williamson.[1] The figures employed have been copied, but the lettering has been changed.

The *length* is measured in the direction or axis of growth, as indicated by the line A B in fig. 1 of Pl. I, and the *breadth* by a line at right angles to the former one, C D in the same figure.

The above terms are applicable for evolute and convolute types, but in certain forms, either monothalamous and rounded or when the growth of chambers is around a central aperture, it is more convenient to use the term *diameter*.

The separate divisions of a shell or test are spoken of as *segments*, designated in fig. 1 of Pl. I as P, I, and U, of which P is the *primordial* and U the *ultimate* segment, while I, holding an intermediate position, is known as an *intermediate* segment. That part of the external surface nearest the end of the ultimate segment is called the *anterior margin* (fig. 1, *a*), while the opposite end is referred to as the *posterior margin* (fig. 1, *p*). These terms have a direct reference to the direction of growth.

The various segments are separated from one another by partitions called *septa*, and these are usually indicated externally by more or less definite constrictions known as *septal lines* (fig. 1, *s*). In old age these constrictions often become filled up and appear as ridges instead of depressions. The *septal plane* is the superficial area of each septum and corresponds in dimensions with the entire breadth of the constricted portion of the shell (fig. 1, *s p*).

Each septum is provided with one or more openings known as *septal apertures*, which serve as a means of communication between contiguous segments. The perforation of the anterior end of the ultimate segment is spoken of as the *oral aperture* (fig. 1, *o a*).

The different views of the shell are referred to as the *anterior*, *lateral*, and *periphero-lateral* aspects. The anterior aspect is seen by looking down upon the septal plane of the ultimate segment; the lateral aspect shows the shell from one side, as in fig. 1; while the periphero-lateral aspect is seen in depressed forms where the shell is viewed from its thin edge, as in fig. 3 of Pl. II. When the segments are arranged in a complete circuit around the primordial cell they constitute a *convolution*. Each convolution joins a contiguous one by a spiral line called the *spiral suture* (Pl. I, fig. 2, *m*). In the simplest case these convolutions are arranged in a single plane, but in more complex types each convo-

[1] On the Recent Foraminifera of Great Britain, Ray Society, London, 1858, pp. 14–18.

lution is formed in a different plane, and a *trochoid* type of shell results, as in Discorbina (fig. 4). The word "rotaliform" is used to express a form in which all of the segments are visible upon the superior surface, but only those of the last convolution are visible upon the inferior surface.

Each side of the shell in convolute types presents a *lateral surface* (fig. 3, L L). The sides of the shell at right angles to these lateral surfaces constitute the *peripheral margin* (fig. 3, *x x*). The margin is very varied in shape, and the angle formed by its outline is called the *peripheral angle.*

The depression formed in the center of the shell is cal ed the *umbilicus.* Sometimes, instead of being depressed the early chambers are raised or elevated into a sort of boss by deposit of exogenous material, but the area is always referred to as the umbilical area, whether raised or depressed.

The terms *superior* and *inferior* lateral surface are constantly referred to and should be clearly understood. When a form continues its convolutions in a single plane both sides remain similar and there is no distinction between the upper and lower lateral surfaces, but when the coils are arranged spirally, as in trochoid types, there is a difference between the surfaces and it becomes necessary to indicate by the terms "superior" and "inferior" the surface referred to.

The term *superior lateral surface* (fig. 4, S L S) is the one in which the primordial segment is situated, while the opposite side, in which the form is extending its growth, is the *inferior lateral surface* (fig. 4, I L S). There are some exceptions to this rule, as, for example, in certain Truncatulina types, which are approximately flat upon the side that bears the primordial segment, as if the shell were cut in halves, the line of division passing through the center of the primordial segment. In such cases the lower (flat) surface becomes the superior lateral side.

The term *distal end* refers to the portion of the shell which carries the oral aperture and is usually farthest removed from the primordial segment. The portion of the shell in which the primordial segment is situated is called the *proximal end.*

It is often necessary to speak of a given type of shell, and therefore the following terms are employed in this report:

1. Nodosarian (Pl. I, fig. 1). Chambers typically arranged in a straight row.

2. Nautiloid (Pl. I, figs. 2 and 3). Chambers wound in a horizontal manner, forming an equilateral spire.

3. Trochoid (Pl. I, fig. 4). Chambers wound around one side of the primordial segment in an inequilateral spire.

4. Textularian (Pl. I, fig. 5). Chambers arranged alternately in an elongated series (biserial).

5. Milioline (Pl. I, fig. 6). Chambers wound spirally about an *imaginary* axis.

DESCRIPTION OF GENERA AND SPECIES.

Subkingdom PROTOZOA.

Class RHIZOPODA.

Order FORAMINIFERA.

Family LITUOLIDÆ.

Subfamily LITUOLINÆ.

Genus HAPLOPHRAGMIUM Reuss.

HAPLOPHRAGMIUM CONCAVUM Bagg.

PLATE II, figs. 1a, 1b.

Test arenaceo-siliceous, rough, of a dull-gray color; consisting of eight or nine chambers, which are concave upon their inner margin, giving the form an approximately triangular outline in transverse section; chambers variable in size; ultimate chamber largest and very slightly elevated in the central portion; septal lines straight, marked by definite deep constrictions; aperture a large elongated oval opening, situated toward the outside edge of the ultimate chamber and nearer the convex side.

Length, 1 mm.; breadth, 0.43 mm.

Locality.—Rancocas formation, Blue Ball, New Jersey.

Geological distribution.—Cretaceous.

HAPLOPHRAGMIUM IRREGULARE (Roemer).

Spirolina irregularis Roemer, 1840–41; Verstein. norddeutsch. Kreide, p. 98, Pl. XV, fig. 29.

Haplophragmium irregulare Reuss, 1860; Sitz. Akad. Wiss. Wien., Vol. XL, p. 219, Pl. X, fig. 9; Pl. XI, fig. 1.

Test arenaceous, rough, flask-shaped; chambers unequal and irregular, at first involute, then evolute and arranged in an elongated series, closely set, numerous (about fifteen), narrow, separated by straight depressed septa; aperture divided.

Length, 2.6 mm.; breadth, 0.6–0.9 mm.

Locality.—Rancocas formation, Vincentown, New Jersey. Rare.

Geological distribution.—Cretaceous.

Subfamily TROCHAMMININÆ.

Genus TROCHAMMINA Parker and Jones.

TROCHAMMINA INFLATA (Montagu).

Nautilus inflatus Montagu, 1808; Test. Brit. Suppl., p. 81, Pl. XVIII, fig. 3.

Trochammina inflata Brady, 1884; Chal. Rept., Vol. IX, p. 338, Pl. XLI, fig. 4, a–c.

"Test free; trochoid or convex, depressed, rotaliform; consisting of about three convolutions, the outermost of which is formed of five or six very ventricose segments with deeply excavated septal lines. Inferior

face somewhat concave, with sunken umbilicus; peripheral margin lobulated. Aperture small, arched; situated on the inferior side of the final segment, close to the previous convolution, a little within the periphery. Color pale brown, the small primary segments much darker than the rest." (Brady, loc. cit.)

The above description agrees closely with the New Jersey specimens, but the color is rather a yellowish white than a brown, and the external view shows only two convolutions instead of three, as in Professor Brady's figure.

Diameter, 0.43 mm.

Locality.—Rancocas formation, Timber Creek, near Mullica Hill, New Jersey.

Geological distribution.—Lias to Recent.

Family TEXTULARIDÆ.

Subfamily TEXTULARINÆ.

TEXTULARIA Defrance.

TEXTULARIA AGGLUTINANS d'Orbigny.

Textularia agglutinans d'Orbigny, 1839; Foram. Cuba, p. 136, Pl. I, figs. 17, 18, 32-34.
Textularia agglutinans Brady, 1884; Chal. Rept., Vol. IX, p. 363, Pl. XLIII, figs. 1-3; var., figs. 4, 12.

Test agglutinous, elongated, of a dull gray color, laterally convex; chambers rather numerous, ten to twelve in long specimens; septa nearly straight; aperture semilunar.

Length, 2.37 mm.

Locality.—Rancocas formation, Vincentown, Mullica Hill, Timber Creek, New Jersey; Manasquan formation, Vincentown, New Jersey.

Geological distribution.—Cretaceous to Recent.

This is a rather common species at Vincentown, where it occurs in the "lime sand." It is interesting to see the small, smooth glauconite grains which help to form the shell substance.

TEXTULARIA AGGLUTINANS var. PORRECTA Brady.

Textularia agglutinans var. *porrecta*, Brady, 1884; Chal. Rept., Vol. IX, p. 364, Pl. XLIII, fig. 4.

Test much elongated, agglutinous, of nearly uniform width; chambers more numerous than in *Textularia agglutinans*, otherwise both forms are very similar.

The New Jersey specimens are not quite so elongated as the figure in the *Challenger* Report.

Length, 2 mm.; breadth, 0.6 mm.

Locality.—Rancocas formation, Vincentown, New Jersey.

Geological distribution.—Cretaceous to Recent.

This form has been described by Tyrrell from the Cretaceous rocks of Canada.

TEXTULARIA GIBBOSA d'Orbigny.

Textularia gibbosa d'Orbigny, 1826; Ann. Sci. Nat., Vol. VII, p. 262, No. 6.
Textularia gibbosa Terrigi, 1891; Mem. R. Com. G. Regno, Vol. IV, pt. 1, p. 68, Pl. I, fig. 10.

Test ovate elongate, smooth, of a dull-gray color; transverse section round; shell composed of only four chambers in each series; septal lines arched, scarcely discernible externally; aperture a median semilunar arch in the ultimate segment.

Length, 0.9–1 mm.

Locality.—Monmouth formation, Freehold, New Jersey.

Geological distribution.—Cretaceous to Recent.

TEXTULARIA GLOBULOSA Ehrenberg.

Textularia globulosa Ehrenberg, 1839; Abhandl. k. Ak. Wiss. Berlin (1838), p. 135, Pl. IV, fig. *β*.
Textularia globulosa Woodward and Thomas, 1885; 13th Ann. Rept. Geol. Nat. Hist. Survey Minnesota for 1884, p. 166, Pl. III, figs. 1-5.

Test small, consisting of a few smooth, spherical, or globular chambers; suture lines deep; shell posteriorly acute, anteriorly obtuse.

Length unknown.

Locality.—Monmouth formation, Freehold, New Jersey. Rare.

Geological distribution.—Cretaceous.

It has been impossible to find shells in perfect preservation, since the constructions between the chambers are so pronounced that the chambers are easily broken off, but the few globular chambers we do find are sufficient for the determination of the species.

TEXTULARIA GRAMEN d'Orbigny.

Textularia gramen d'Orbigny, 1846; Foram. Foss. Bassin tert. Vienne, p. 248, Pl. XV, figs. 4–6.
Textularia gramen Brady, 1884; Chal. Rept., Vol. IX, p. 365, Pl. XLIII, figs. 9, 10.

Test arenaceous, rough externally, stoutly built, laterally compressed, margin subangular; five to six wide chambers, very slightly convex; posterior end neatly rounded; general outline very similar to *Textularia hauerii*, but distinguished from that species by its more angular lateral edges, and differing from *Textularia abbreviata*, which it also resembles, in being less short and thick.

Length, 1 mm.; breadth, 0.52 mm.

Locality.—Rancocas formation, Vincentown, Timber Creek, etc., New Jersey.

Geological distribution.—Cretaceous to Recent.

TEXTULARIA SAGITTULA Defrance.

Textularia sagittula Defrance, 1824; Dict. Sci. Nat., Vol. XXXII, p. 177; 1828, Vol. LIII, p. 344; Atlas, Conch., Pl. XIII, fig. 5.
Textularia sagittula Brady, 1884; Chal. Rept., Vol. IX, p. 361, Pl. XLII, figs. 17, 18.

Test elongated, strongly compressed, with sharp-angled peripheral margin; chambers numerous (12 to 15), closely set, visible externally in the upper portion only; septal lines almost straight, curving very gently toward the central portion; aperture linear.

Length, 0.45–0.55 mm.

Locality.—Rancocas formation, Vincentown, New Egypt, Timber Creek, New Jersey.

Geological distribution.—Cretaceous to Recent.

TEXTULARIA TURRIS d'Orbigny.

Textularia turris d'Orbigny, 1840; Mém. Soc. Géol. France, ser. 1., Vol. IV, p. 46, Pl. IV, figs. 27, 28.

Textularia turris Brady, 1884; Chal. Rept., Vol. IX, p. 366, Pl. XLIV, figs. 4, 5.

Test nearly round in transverse section, elongate, conical, rugose, tapering, anteriorly truncate; chambers numerous, complanate, somewhat irregular, quite distinct at the distal end.

Length, 1 mm.

Locality.—Rancocas formation, Vincentown, Timber Creek, New Jersey.

Geological distribution.—Cretaceous to Recent.

Genus VERNEUILINA d'Orbigny.

VERNEUILINA POLYSTROPHA (Reuss).

Bulimina polystropha Reuss, 1845–46; Verstein. böhm. Kreide, pt. 2, p. 109, Pl. XXIV, fig. 53.

Verneuilina polystropha Brady, 1884; Chal. Rept., Vol. IX, p. 386, Pl. XLVII, figs. 15–17.

Test arenaceous, rough, somewhat triangular, composed of only a few chambers, which increase very rapidly in size from below downward; aperture a central arched opening in the ultimate segment.

Length, 0.43 mm.

Locality.—Monmouth formation, Freehold, New Jersey.

Geological distribution.—Cretaceous to Recent.

VERNEUILINA TRIQUETRA (Münster).

Plate II, fig. 2.

Textularia triquetra Münster, 1838; in Roemer's paper, Neues Jahrb., p. 384, Pl. III, fig. 19.

Textularia atlantica Bailey, 1851; Smithsonian Contrib., Vol. II, art. 3, p. 12, figs. 38–43.

Verneuilina triquetra Brady, 1884; Chal. Rept., Vol. IX, p. 383, Pl. XLVII, figs. 18–20.

Test composed of coarse sand grains and scattered grains of glauconite, triserial; chambers with flattened sides, definitely marked by sutures, eight to ten in each series; transverse section an almost equilateral triangle; surface rugose, and the coarse sand grains are interspersed with grains of glauconite; septal lines arched in the central

portion and directed downward toward the edges; triangular edges not always straight, but curved somewhat in passing from the primordial to the distal end; aperture a median elongated slit with a depressed margin.

The shell is of a dull-gray color, and attains large size.

An analysis of *Verneuilina triquetra* gave 41.37 per cent of silica. The sand grains are very firmly cemented by calcareous substance which forms the base of the shell.

It is a very common species.

Length, 3.13 mm.

Locality.—Rancocas formation, Vincentown, Mullica Hill, and Timber Creek, New Jersey. Manasquan formation, Vincentown, New Jersey.

Geological distribution.—Cretaceous to Recent.

Genus TRITAXIA Reuss.

TRITAXIA TORTILIS (Reuss).

Bulimina tortilis Reuss, 1861; Sitz. Akad. Wiss. Wien, Vol. XLIV, pt. 1, p. 338, Pl. VIII, fig. 3, a, b.

Test small, trihedral; chambers few, five to seven in each series, somewhat inflated and depressed at the septal lines; peripheral margins rather sharp; primordial end bluntly pointed; ultimate segment large, overreaching, and bearing the elliptical aperture near the upper part of the septal face.

Length, 0.52 mm.

Locality.—Rancocas formation, Swedesboro, New Jersey.

Geological distribution.—Cretaceous.

TRITAXIA TRICARINATA (Reuss).

Textularia tricarinata Reuss, 1845–46; Verstein. böhm. Kreide, pt. 1, p. 39, Pl. VIII, fig. 60.

Tritaxia tricarinata Brady, 1884; Chal. Rept., Vol. IX, p. 389, Pl. XLIX, figs. 8, 9.

Test tricarinate; lateral surfaces slightly concave, consisting of a few (four or five) rather indistinct segments in each row; aperture central, rotund, in a short elevated neck.

Length, 1.3 mm.

Locality.—Rancocas formation, Swedesboro, Timber Creek, New Jersey; Manasquan formation, Vincentown, New Jersey.

Geological distribution.—Cretaceous to Recent.

Genus GAUDRYINA d'Orbigny.

GAUDRYINA PUPOIDES d'Orbigny.

Gaudryina pupoides d'Orbigny, 1840; Mém. Soc. géol. France, ser. 1, Vol. IV, p. 44, Pl. IV, figs. 22–24.

Gaudryina pupoides Brady, 1884; Chal. Rept., Vol. IX, p. 378, Pl. XLVI, figs. 1–4.

"*Gaudryina pupoides* is an easily recognized species. Its dimorphous mode of growth is generally very apparent, and its variability is

limited to such features as the number of segments, the relative length and breadth of the test, and the degree of lateral compression. In recent shells the walls are thin and calcareous, smooth externally, and almost invariably of a grayish hue; fossil specimens sometimes exhibit slightly rough exterior. In form and position the aperture resembles that of the typical Textulariæ, but it is often surrounded by a raised tip or border." (Brady, loc. cit.)

Length, 2 mm.

Locality.—Rancocas formation, Vincentown, New Jersey.

Geological distribution.—Cretaceous to Recent.

Genus CLAVULINA d'Orbigny.

CLAVULINA COMMUNIS d'Orbigny.

Clavulina communis d'Orbigny, 1826; Ann. Sci. Nat., Vol. VII, p. 268, No. 4.
Clavulina communis, d'Orbigny, 1846; Foram. Foss. Bassin tert. Vienne; p. 196, Pl. XII, figs. 1, 2.

Test elongate, straight, rough externally and arenaceous; early segments triquetrous, spiral, and forming a pointed apex, a transverse section of which is round, not angular as in *Clavulina parisiensis* d'Orbigny; anterior chambers marked by depressed septa, somewhat irregular in size, but the ultimate one is the largest; aperture normally a central opening in a short tubular neck of the ultimate chamber.

Length, 2.1 mm.

Locality.—Rancocas formation, Brownsville, New Jersey.

Geological distribution.—Upper Cretaceous to Recent.

CLAVULINA PARISIENSIS d'Orbigny.

Clavulina parisiensis d'Orbigny, 1826; Ann. Sci. Nat., Vol. VII, p. 268, No. 3; Modèle, No. 66.
Clavulina parisiensis Brady, 1884; Chal. Rept., Vol. IX, p. 395, Pl. XLVIII, figs. 14–18.

Test coarsely arenaceous, elongated, straight or nearly so; ultimate chambers nodosarian, short, marked by straight, somewhat depressed septa; primordial segments triquetrous as in *Clavulina communis* d'Orbigny, but wedge-shaped and triangular in outline instead of being rounded; aperture a central opening in a short tubular neck.

Length, 2.4 mm.

Locality.—Rancocas formation, Brownsville, New Jersey.

Geological distribution.—Cretaceous to Recent.

Occurs with the preceding not rarely in the lime sand of Brownsville.

Subfamily BULIMININÆ.

Genus BULIMINA d'Orbigny.

BULIMINA PUSCHI Reuss.

Bulimina puschi Reuss, 1851; Haidinger's Naturw. Abhandl., Vol. IV, pt. 1, p. 37, Pl. III, fig. 6.

Test elongate oval, obtusely rounded above, acutely rounded below,

shell wall very punctate; chambers rapidly increasing in size from below upward, irregularly wedge-shaped, moderately depressed at the sutures; aperture a comma-shaped slit near the margin of the ultimate segment.

Length, 0.5 mm.

Locality.—Monmouth formation, Freehold, New Jersey. Very rare.

Geological distribution.—Cretaceous.

BULIMINA VARIABILIS d'Orbigny.

Bulimina variabilis d'Orbigny, 1840; Mém. Soc. géol. France, ser. 1, Vol. IV, pt. 1, p. 40, Pl. IV, figs. 9–12.

Bulimina variabilis Reuss, 1845–46; Verstein. böhm. Kreide, pt. 1, p. 37, Pl. VIII, figs. 56, 76, 77.

Test variable, ovate or oblong, very finely perforate; spire short, obtuse posteriorly; segments few, very narrow, slightly oblique; ultimate chamber ending in a flat surface; aperture oval, situated at the inner margin.

Diameter, 0.2–0.3 mm.

Locality.—Monmouth formation, Freehold, New Jersey.

Geological distribution.—Cretaceous.

This small species from the New Jersey marl beds agrees closely with the figures of Professor Reuss. It has been recognized only in the lower marl bed at Freehold, and is a rare form.

Genus BOLIVINA d'Orbigny.

BOLIVINA PUNCTATA d'Orbigny.

Plate II, fig. 3.

Bolivina punctata d'Orbigny, 1839; Foram. Amér. Merid., p. 63, Pl. VIII, figs. 10–12.

Bolivina antiqua d'Orbigny, 1846; Foram. Foss. Bassin tert. Vienne, p. 240, Pl. XIV, figs. 11–13.

Bolivina punctata Brady, 1884; Chal. Rept., Vol. IX, p. 417, Pl. LII, figs. 18, 19.

Test elongate, textulariform, smooth, compressed, finely perforate, anterior end obtuse, posterior acute, lateral margins subcarinate; chambers five to seven in each series; septal lines depressed; aperture terminal, simple, oval.

Length, 0.35 mm.; greatest breadth, 0.15 mm.

Locality.—Matawan formation, Marshalltown, New Jersey; Monmouth formation, Freehold, and Bruere's pits on Crosswicks Creek, New Jersey.

Geological distribution.—Cretaceous to Recent.

This species is common at Freehold. It resembles *Bolivina textilaroides* Reuss in the small number of chambers and somewhat broader outline, but differs from this latter species in being much more oval in outline when seen in transverse section.

BOLIVINA TEXTILAROIDES Reuss.

Bolivina textilaroides Reuss, 1862; Sitz. Akad. Wiss. Wien, Vol. XLVI, p. 81, Pl. X, fig. 1.

Bolivina textilaroides Brady, 1884; Chal. Rept., Vol. IV, p. 419, Pl. LII, figs. 23-25.

Test textulariform; segments few in number, about six in each series; septal lines depressed, and the chambers somewhat inflated; surface smooth, finely punctate; peripheral margins rounded, and more or less lobulated.

Length, 1 mm.

Locality.—Matawan formation, Marshalltown, New Jersey.

Geological distribution.—Cretaceous to Recent.

This species is less common than *Bolivina punctata.*

Genus PLEUROSTOMELLA Reuss.

PLEUROSTOMELLA SUBNODOSA Reuss.

Nodosaria nodosa (pars) Reuss, 1845-46; Verstein. böhm. Kreide, pt. 1, p. 28, Pl. XIII, fig. 22.

Dentalina subnodosa (pars) Reuss, 1850; Haidinger's Naturw. Abhandl., Vol. IV, pt. 1, p. 24, Pl. I, fig. 9.

Pleurostomella subnodosa Brady, 1884; Chal. Rept., Vol. IX, p. 412, Pl. LII, figs. 12, 13.

Test elongate, almost straight, with somewhat irregular outline; chambers enlarging, slightly convex, separated by oblique sutures; ultimate chamber largest, shortly acute; primordial chamber smallest, rounded; aperture an elongated, naked, oval opening extending slightly down the side of the ultimate segment.

Length, 1 mm.

Locality.—Rancocas formation, Timber Creek, New Jersey.

Geological distribution.—Cretaceous to Recent.

Family LAGENIDÆ.

Subfamily LAGENINÆ.

Genus LAGENA Walker and Boys.

LAGENA GLOBOSA (Montagu).

Vermiculum globosum Montagu; Testac. Brit., 1803, p. 523.

Oolina simplex Reuss, 1851; Haidinger's Naturw. Abhandl., Vol. IV, pt. 1, p. 22, Pl. I, fig. 2.

Lagena globosa Reuss, 1863; Sitz. Akad. Wiss. Wien, Vol. XLVI, pt. 1, p. 318, Pl. I, figs. 1-3.

Lagena globosa Brady, 1884; Chal. Rept., Vol. IX, p. 452, Pl. LVI, figs. 1-3.

Test subglobular, elliptical or pyriform; surface smooth; finely perforate shell with thin, hyaline cell walls; anterior margin somewhat projecting, with aperture in an entorolenian neck.

Length, 2 mm.; breadth, 1.5 mm.

Locality.—Rancocas formation, Vincentown and Mullica Hill, New Jersey.

Geological distribution.—Jurassic to Recent.

Genus VITREWEBBINA Chapman.

"Test opaque to translucent, of a whitish or pale-brown color. Shell wall very finely perforated, consisting of a single hemispherical or pyriform chamber, or of a graduated series dispersed usually in a curved line, and adherent upon some foreign substance. The chambers are connected by stolon tubes, very distinctly seen on the under surfaces of the specimens which have become detached. The surface of the shell may be smooth, pitted, or, as in Dr. Sollas's specimen, tuberculate."[1]

VITREWEBBINA SOLLASI Chapman.

Plate II, figs. 5a, 5b.

Vitrewebbina sollasi Chapman, 1892; Geol. Mag., n. s., decade 3, Vol. IX, No. 2, Feb., pp. 53-54, Pl. II, fig. 4.

Test smooth, adherent, hyaline, finely perforate; consisting of one or many chambers arranged in a more or less curving irregular chain; chambers attached by stoloniferous tubes; aperture terminal in ultimate chamber; length variable, dependent upon the number of chambers.

Breadth, 0.2–0.6 mm.; shell diameter, 0.01 mm.

Locality.—Rancocas formation, Vincentown, New Jersey.

Geological distribution.—Cretaceous.

This is a very common form at Vincentown, and is frequently found adhering to *Flabellina sagittaria*, although often occurring on other shell fragments. Although the primordial chamber is generally the smallest and the ultimate the largest, there is no regularity of arrangement in regard to size of the chambers.

It was with some difficulty that the position of this form was determined. The structure of the shell substance alone separates it from *Trochammina irregularis* Carpenter,[2] but solution of the shell in hydrochloric acid failed to reveal any trace of arenaceous or siliceous material, although in some cases there was an inner coating of amorphous material remaining insoluble in the acid.

A form similar to the one under discussion is figured by Quenstedt[3] and described by him as *Bullopora rostrata* in the following words: "This consists of simple, small, dark hemispheres, united with each other through lengthened tubes. This tube often projects from the end cell like a beak, whence I have given it its name. Generally the pustules (chambers) increase in size, with now and then smaller ones between, while the primordial cell is similar to those succeeding." This species is described by Schwager[4] as *Placopsilina rostrata*, and is placed under the calcareous perforate division of the Dentaloidea.

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[1] Chapman, Geol. Mag., n. s., decade 3, Vol. IX, No. 2, Feb. 1892, p. 53.

[2] Introduction to the Study of the Foraminifera, p. 142, Pl. XI, figs. 6–10.

[3] Der Jura, 1858, p. 580, Atlas, Pl. LXXIII, fig. 28.

[4] Bollettino del R. Comitato Geol. d'Italia, 1877, Vol. VIII, p. 18, Pl. fig. 12.

In the original description of the genus Placopsilina[1] no mention is made of the nature of the test, whether of arenaceous or calcareous composition, but later authorities (Brady[2]) consider the genus under arenaceous types of the Lituolidæ.

The tubulated structure of the genus Webbina, simulating the arenaceous Trochamminæ, is quite striking, and its calcareous composition in this case led to a discussion by Dr. W. J. Sollas,[3] "On the perforate character of the genus Webbina," etc., and the later establishment of a new genus, Vitrewebbina, by Frederick Chapman,[4] which I have adopted as a solution of the difficulty presented by this isomorphous form.

VITREWEBBINA LÆVIS (Sollas).

Plate II, figs. 4a, 4b.

Webbina lævis, Sollas, 1877; Geol. Mag., n. s., decade 2, Vol. IV, No. 3, March, pp. 103–104, Pl. VI, figs. 1–3.

Test very similar to *Vitrewebbina sollasi* in shape and general appearance, and differing from that species only in having no external marginal flange and in being somewhat more elevated. The form occurs with the preceding in the lime sand at Vincentown, but is not very common, while *Vitrewebbina sollasi* is rather plentiful.

Locality.—Rancocas formation, Vincentown, New Jersey.

Geological distribution.—Cretaceous.

Subfamily NODOSARINÆ.

Genus NODOSARIA Lamarck.

NODOSARIA ACUMINATA (Reuss).

Dentalina acuminata Reuss 1860; Sitz. Akad. Wiss. Wien, Vol. XL, p. 181, Pl. I, fig. 7.

Test elongate, straight, tapering sharply; surface smooth; nine oval, regular chambers, rapidly increasing in size toward the distal end; primordial end acuminate; ultimate chamber globose, anteriorly prolonged into a distinct eccentric tube; septa depressed, transverse; aperture nipple-shaped.

The above species is very similar to *Dentalina subrecta* Reuss, but the latter has fewer segments and the proximal end less acuminate.

Length, 0.9 mm.

Locality.—Rancocas formation, Vincentown, New Jersey.

Geological distribution.—Cretaceous.

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[1] d'Orbigny, A. D., Prodrome de Paleontologie Stratigraphique, 1850, Vol. II, p. 96.

[2] *Challenger* Report, 1884, Vol. IX, p. 314.

[3] Geol. Mag., n. s., decade 2, Vol. IV, No. 3, March, 1877, pp. 102–105.

[4] Geol. Mag., n. s., decade 3, Vol. IX, No. 2, Feb., 1892, p. 53.

NODOSARIA ADOLPHINULA (d'Orbigny).

Dentalina adolphinula d'Orbigny, 1846; Foram. Foss. Bassin tert. Vienne, p. 51, Pl. II, figs. 18–20.
Dentalina adolphinula Sherborn and Chapman, 1886; Jour. Roy. Micros. Soc., ser. 2, Vol. VI, p. 750, Pl. XV, figs. 11, *a*, *b*, 12.

Test composed of six or seven short, oval chambers, very strongly separated by septal constrictions. The anterior portions of the ultimate chambers are smooth, but upon the lower ends of these are two rows of spines or tubercles jutting out at a low angle from the surface. Upon the primordial segments these spines are found to cover the whole surface. Primordial chamber armed with a short spine; ultimate segment ending in a tubular neck, which carries the round aperture.

Length, 1 mm. and over.

Locality.—Rancocas formation, southeast Swedesboro, New Jersey.

Geological distribution.—Cretaceous to Recent.

This small nodosarian form is not uncommon in the lime-sand beds below Swedesboro.

NODOSARIA ANNULATA Reuss.

Nodosaria annulata Reuss, 1844; Geogn. Skizze Böhmen, Vol. II, pt. 1, p. 210.
Nodosaria annulata Reuss, 1845–46; Verstein. böhm. Kreide, pt. 1, p. 27, Pl. VIII, figs. 4, 67. Pl. XIII, fig. 21.

Test smooth and glistening, arcuate, very elongate, tapering sharply to a point toward the proximal end; chambers spherical, numerous, fifteen to twenty, more constricted and globose toward the ultimate chamber, which is prolonged somewhat in its upper portion and carries the round mammillate aperture; septa transverse, definitely depressed at the anterior end.

This is one of the largest of all our nodosarian types. It resembles the specimens of *Nodosaria obliqua*, but is easily distinguished from the latter by its smooth surface. The proximal end of the shell sometimes shows very faint striæ as indications of ribs, but these are never prominent, and are visible only under the microscope.

Length, over 10 mm. in long specimens; breadth of largest chamber, 1 mm.

Locality.—Monmouth formation, Freehold, New Jersey; Rancocas formation, Vincentown, New Jersey.

Geological distribution.—Cretaceous.

NODOSARIA COMMUNIS (d'Orbigny.)

Dentalina communis d'Orbigny, 1826; Ann. Sci. Nat., Vol. VII, p. 254, No. 35.
Nodosaria communis Brady, 1884; Chal. Rept., Vol. IX, p. 504, Pl. LXII, figs. 19–22.

Test elongate, slightly arcuate, smooth; septa oblique, depressed; chambers numerous, ten to fifteen, convex anteriorly; aperture small, radiate, situated near the incurved margin.

Length, 3.26 mm.

Locality.—Monmouth formation, Cream Ridge, Bruere's pits on Crosswicks Creek, New Jersey; Rancocas formation, New Egypt, Mullica Hill, Timber Creek, New Jersey.

Geological distribution.—Permian to Recent.

NODOSARIA CONSOBRINA (d'Orbigny.)

Dentalina consobrina d'Orbigny, 1846; Foram. Foss. Bassin tert. Vienne, p. 46, Pl. II, figs. 1–3.

Nodosaria consobrina Brady, 1884; Chal. Rept., Vol. IX, p. 501, Pl. LXII, figs. 23, 24.

Test smooth, dentaline, attenuated, and graceful; chambers nine or ten, shorter and less distinct at the proximal end but becoming more definite above and more elongated; septa distinct, straight, or nearly so, becoming more marked in the proximal extremity; ultimate chamber somewhat prolonged into a neck which carries the oral aperture; proximal end very neatly rounded.

Length, 2 mm.

Locality.—Matawan formation, Marshalltown, New Jersey.

Geological distribution.—Cretaceous to Recent.

This slender little species is very closely allied to the emaciate variety found in the Rancocas marl beds, but it is not so elongated and has a much smaller number of chambers.

NODOSARIA CONSOBRINA var. EMACIATA Reuss.

Nodosaria (D.) *consobrina*, var. *emaciata*, Reuss, 1865; Denks. Akad. Wiss. Wien, Vol. XXV, p. 132, Pl. II, figs. 12, 13.

Nodosaria (D.) *consobrina*, var. *emaciata*, Brady, 1884; Chal. Rept., Vol. IX, p. 502, Pl. LXII, figs. 25, 26.

Test smooth, greatly elongated, tapering; segments numerous, short, elongate oval; similar to *Nodosaria consobrina*, but more elongated and slender; septa somewhat depressed, transverse, primordial end rounded; aperture mammillate, somewhat prolonged into a tube.

Length, 2 mm.

Locality.—Matawan formation, Marshalltown, New Jersey; Rancocas formation, Vincentown, New Jersey.

Geological distribution.—Cretaceous to Recent.

NODOSARIA FARCIMEN (Soldani).

Orthoceras farcimen Soldani, 1791; Testaceographia, Vol. I, pt. 2, p. 98, Pl. CV, Fig. O.

Dentalina farcimen Reuss, 1863; Bull. Acad. Roy. Belge, ser. 2, Vol. XV, p. 146, Pl. I, fig. 18.

Test arcuate, tapering, with from six to ten inflated segments, separated by deep, straight, transverse sutures. The latter quality separates this species from *Nodosaria communis*, in which the sutures are oblique. There is also an irregularity in the increase of the size of the

chambers noticeable in most specimens. The ultimate chamber is prolonged into a round tube which bears the oral opening.

Length, 2.82 mm.

Locality.—Rancocas formation, New Egypt, New Jersey.

Geological distribution.—Permian to Recent.

NODOSARIA FILIFORMIS d'Orbigny.

Nodosaria filiformis d'Orbigny, 1826; Ann. Sci. Natur., Vol. VII, p. 253, No. 14.
Dentalina gracilis d'Orbigny, 1840; Mém. Soc. géol. France, ser. 1, Vol. IV, p. 14, Pl. I, fig. 5.
Nodosaria filiformis Brady, 1884; Chal. Rept., Vol. IX, p. 500, Pl. LXIII, figs. 3–5.

Test slender, elongated, smooth, crenate; chambers numerous (12), distinct, elongate oval; septa transverse, nonoblique; aperture simple, round.

Length, 2.1 mm.

Locality.—Monmouth formation, Cream Ridge, Redbank, New Jersey; Rancocas formation, Mullica Hill, Timber Creek, New Jersey.

Geological distribution.—Lias to Recent.

NODOSARIA INDIFFERENS (Reuss).

Dentalina indifferens Reuss, 1863; Sitz. Akad. Wiss. Wien, Vol. XLVIII, pt. 1, p. 44, Pl. II, figs. 15, 16.

Test consisting of from six to eight smooth, short, inflated chambers of unequal size; primordial chamber larger than the succeeding one, obtusely rounded; ultimate chamber large and more constricted than any of the other chambers.

Length, 1.7 mm.

Locality.—Monmouth formation, Cream Ridge, New Jersey.

Geological distribution.—Cretaceous and Tertiary.

NODOSARIA INORNATA (d'Orbigny).

Dentalina inornata d'Orbigny, 1846; Foram. Foss. Bassin tert. Vienne, p. 44, Pl. I, figs. 50, 51.
Dentalina inornata Sherborn and Chapman, 1886; Jour. Roy. Microsc. Soc., ser. 2, Vol. VI, pt. 2, p. 750, Pl. XV, fig. 8.

Test smooth, gently tapering, with chambers distinct and more indented upon one side than upon the other; septa very oblique, and curving very slightly in the central, and more markedly so near the margin of the lowest end of each chamber; aperture nearer one side.

Only three segments preserved.

Length unknown.

Locality.—Matawan formation, Marshalltown, New Jersey.

Geological distribution.—Cretaceous and Tertiary.

The New Jersey specimens are almost identical with the form figured by Sherborn and Chapman from the London clay of England.

According to Professor Brady, this species is considered to be identical with *Nodosaria communis* d'Orbigny, and is given by him as a synonym under that name, but it is here kept distinct for several reasons, as it is by Chapman and Sherborn.

NODOSARIA LÆVIGATA d'Orbigny.

Nodosaria (*Glandulina*) *lævigata* d'Orbigny, 1826; Ann. Sci. Nat., Vol. VII, p. 252, Pl. X, figs. 1–3.

Glandulina lævigata d'Orbigny, 1846; Foram. Foss. Bassin tert. Vienne, p. 29, Pl. I, figs. 4, 5.

Nodosaria lævigata Brady, 1884; Chal. Rept., Vol. IX, pp. 490, 493, Pl. LXI, figs. 17–22, 32.

Test cylindrical, tapering rapidly to a point at the primordial chamber; shell smooth, consisting of five or six short, indistinct segments; septal lines transverse; aperture round, crenulate.

This small species occurs sparingly in the lime sand at Vincentown. The American specimens are very similar to the forms from Germany figured by Professor Reuss under the name *Glandulina elliptica*.[1]

Length, 0.65 mm.

Locality.—Rancocas formation, Vincentown, New Jersey.

Geological distribution.—Cretaceous to Recent.

NODOSARIA LONGISCATA d'Orbigny.

Nodosaria longiscata d'Orbigny, 1846; Foram. Foss. Bassin tert. Vienne, p. 32, Pl. I, figs. 10–12.

Test elongate, smooth, consisting of chambers greatly extended and united end to end by definite constrictions. The forms are never found of full length, owing to the weak jointing of the segments, which allows them to break apart very readily. The species is somewhat similar to *Nodosaria ovulata* Sherborn and Chapman, but the chambers are not angular at their base, as in the latter species.

Length unknown.

Locality.—Manasquan formation, Vincentown, New Jersey.

Geological distribution.—Cretaceous and Tertiary.

NODOSARIA MULTICOSTATA (d'Orbigny).

Dentalina multicostata d'Orbigny, 1840; Mém. Soc. géol. France, ser. 1, Vol. IV, p. 15, Pl. I, figs. 14, 15.

Test large, abruptly tapering, arcuate; surface marked by numerous (24 at the anterior end) sharp, distinct, longitudinal costæ, slightly twisted and irregular in their arrangement; chambers nine or ten, short, deeply constricted, becoming more distinct toward the proximal end; aperture small, rotund, ending in a definitely constricted neck surrounded by a crenulated margin.

Length, 4–5 mm.

[1] Sitz. Akad. Wiss. Wein, 1863, Vol. XLVIII, p. 47, Pl. III, figs. 29–31.

Locality.—Rancocas formation, Blue Ball, New Jersey.

Geological distribution.—Carboniferous to Cretaceous.

NODOSARIA NITIDA d'Orbigny.

Nodosaria nitida d'Orbigny, 1826; Ann. Sci. Nat., Vol. VII, p. 254, No. 33.

Nodosaria nitida Parker, Jones, and Brady, 1871; Ann. Nat. Hist., ser. 4, Vol. VIII, p. 158, Pl. IX, fig. 44.

Nodosaria nitida Tate and Blake, 1876; Yorkshire Lias, p. 457, Pl. XVII, fig. 19.

"A small striate Nodosaria, deeply constricted at its septa and having few, distinct, oval, or fusiform segments. A less robust form than *Nodosaria scalaria*, and less neatly finished as to base and terminal neck than that species generally is." (Parker, Jones, and Brady, loc cit.)

Owing to the deep constrictions, this form is easily broken, and I have no specimens with more than three segments. The ribs are very distinct and elevated, and there are small intermediate striæ between some, but not all, of the main costæ. The aperture ends in a phialine neck.

Length (of the three ultimate segments), 2.82 mm.

Locality.—Rancocas formation, Blue Ball, New Jersey.

Geological distribution.—Lias to Recent (?).

NODOSARIA OBLIQUA (Linné).

Nautilus obliquus Linné, 1767; Syst. Nat., twelfth ed., pp. 281, 1163; 1788, ibid., thirteenth (Gmelins) ed., p. 3372, No. 14.

Nodosaria sulcata Nilsson, 1827; Petrefacta Suec., p. 8, Pl. IX, fig. 19.

Dentalina sulcata d'Orbigny, 1840; Mém. Soc. géol. France, ser. 1, Vol. IV, p. 15, Pl. I, figs. 10–13.

Dentalina steenstrupi Reuss, 1855; Zeits. deutsch. geol. Gesell., Vol. VII, p. 268, Pl. VIII, fig. 14a.

Dentalina sulcata Reuss; ibid., p. 269, Pl. VIII, fig. 14b.

Dentalina obliqua Jones, Parker, and Brady, 1866; Monograph Foram. Crag, Pal. Soc. Vol. XIX, p. 54, Pl. I, fig. 9.

Test very large, elongated, arcuate, tapering; septal lines depressed; numerous costæ upon the surface, which vary in size and number in different specimens; chambers numerous, ventricose, distinct; aperture central, radiate. Some specimens end in a spine at the distal end.

Length, 2–13.5 mm.

Locality.—Matawan formation, Marshalltown, New Jersey; Monmouth formation, Freehold, New Jersey; Rancocas formation, Vincentown, Blue Ball, Mullica Hill, Timber Creek, Harrisonville, New Egypt, New Jersey; Manasquan formation, Vincentown, New Jersey.

Geological distribution.—Lias to Recent.

This species is very common in the New Jersey marl beds and is one of the few forms which are found in all the horizons of the Upper Cretaceous series.

The Matawan specimens are only 2 mm. in length.

NODOSARIA PAUPERATA (d'Orbigny).

Dentalina pauperata d'Orbigny, 1846; Foram. Foss. Bassin tert. Vienne, p. 46, Pl. I, figs. 57, 58.

Nodosaria pauperata Brady, 1884; Chal. Rept., Vol. IX, p. 500, woodcuts, fig. 14a, b, c.

Test smooth, somewhat arcuate, tapering very gradually; chambers quite uniform in size, ten or eleven in number, not constricted in the lower portion of the shell, but becoming distinct and more constricted as they approach the proximal end; ultimate segment prolonged, provided with a constricted tube-like neck which carries the round aperture.

Length, 2–3 mm.

Locality—Manasquan formation, Vincentown, New Jersey.

Geological distribution—Lias to Recent.

NODOSARIA POLYGONA Reuss.

Nodosaria polygona Reuss, 1855; Zeits. deutsch. geol. Gesell., p. 265, Pl. VIII, figs. 7, 8.

Test cylindrical, elongate, costate, tapering very gradually, straight or but slightly curved; chambers numerous, ten to sixteen, becoming more constricted and globose toward the ultimate segment; primordial chamber larger than the one succeeding, bulbous, mucronate; ultimate chamber terminates in a short tubular neck, in which the round oral aperture is situated; longitudinal costæ few in number, eight to ten, very distinct, and elevated and extending from end to end.

Length, sometimes 9 mm.

The specimens from the Matawan marl beds are small (1.1 mm. in length), and have only six chambers, and are rare, while the Rancocas forms are very numerous and are among the largest of the Nodosariæ from New Jersey.

Locality—Matawan formation, Marshalltown, New Jersey; Monmouth formation, Freehold, New Jersey; Rancocas formation, New Egypt, Blue Ball, Harrisonville, New Jersey; Manasquan formation, Vincentown, New Jersey.

Geological distribution—Cretaceous to Recent.

NODOSARIA RADICULA (Linné).

Nautilus radicula Linné, 1767; Syst. Nat., twelfth ed., pp. 285, 1164; 1788, ibid., thirteenth (Gmelin's) ed., p. 3373, No. 18.

Nodosaria radicula d'Orbigny, 1826; Ann. Sci. Nat., Vol. VII, p. 252, No. 3; Model No. 1.

Nodosaria radicula Brady, 1876; Palæont. Soc., Vol. XXX, p. 124, Pl. X, figs. 6–16.

Test straight, elongated, tapering, composed of from four to seven subglobose segments; surface of shell smooth; septal lines transverse, depressed; aperture a nipple-shaped protuberance on the ultimate segment.

Length, 2 mm.

Locality.—Rancocas formation, Timber Creek, New Jersey.

Geological distribution.—Permian to Recent.

NODOSARIA RAPHANUS (Linné).

Nautilus raphanus Linné, 1767; Syst. Nat., twelfth ed., pp. 283, 1164; 1788, ibid., thirteenth (Gmelin's) ed., p. 3373, No. 16.
Nodosaria raphanus Silvestri, 1872; Nodos. Fos. Viv. d'Italia, p. 43, Pl. IV, figs. 67–81.
Nodosaria raphanus Brady, 1884; Chal. Rept., Vol. IX, p. 512, Pl. LXIV, figs. 6–10.

Test elongate, straight, somewhat tapering, stoutly built; surface marked by eight sharp, elevated, distinct costæ; chambers few in number, generally fewer than ten, not very distinct, since the septal lines are nonlimbate; aperture a semilunar arch, median, surrounded by a thickened border.

Length, 1 mm.

Locality.—Rancocas formation, southeast Swedesboro, Timber Creek, New Jersey.

Geological distribution.—Upper Trias to Recent.

NODOSARIA ROEMERI (Neugeboren.)

Dentalina roemeri Neugeboren, 1856; Denks. Akad. Wiss. Wien., Vol XII, pt. 2, p. 82. Pl. II, figs. 13–17.
Nodosaria roemeri, Brady, 1884; Chal. Rept., Vol. IX, p. 505, Pl. LXIII, fig. 1.

Test smooth, consisting of six or seven large chambers separated by nearly straight, slightly depressed sutures; primordial chamber rounded and rather blunt; ultimate chamber carrying the oral aperture nearer the incurved margin. Some specimens are slightly curved, but the curvature is never very great.

Length, 0.82 mm.

Locality.—Matawan formation, Marshalltown, New Jersey.

Geological distribution.—Cretaceous to Recent.

NODOSARIA ROTUNDATA (Reuss.)

Glandulina rotundata Reuss, 1850; Denks. Akad. Wiss. Wien., Vol. I, p. 366, Pl. XLVI. fig. 2.
Glandulina obtussima Reuss, 1863; Sitz. Akad. Wiss. Wien., Vol. XLVIII, pt. 1, p. 66, Pl. VIII, figs. 92, 93.

Test oval, not much elongated, with rounded base, consisting of only two or three segments, usually two, of which the ultimate chamber is much the largest; surface of shell smooth and white; aperture small, rotund, crenulate, placed centrally in ultimate chamber.

Length, 1–3 mm.

This is not an uncommon form in the limes and at Vincentown. Our specimens agree very closely with those figured by Professor Reuss.

Locality.—Rancocas formation, Vincentown, New Jersey.

Geological distribution.—Cretaceous to Recent.

NODOSARIA SCABRA (Reuss).

Dentalina scabra Reuss, 1850; Denk. Akad. Wiss. Wien, Vol. I, p. 367, Pl. XLVI, figs. 7, 8.

Test small, elongate, tapering; surface uniformly covered with raised longitudinal striæ, or tubercles, visible only under high power in

reflected light; chambers eight in number, strongly constricted, becoming quite spheroid in the upper portion; primordial chamber furnished with a long, delicate spine upon the inside edge of the line of flexure; ultimate chamber prolonged into a round phialine neck; aperture rotund.

Length, 1 mm.

Locality.—Manasquan formation, Vincentown, New Jersey.

Geological distribution.—Cretaceous and Tertiary.

Reuss describes this form as being very variable in character, and states that there are two extreme types, which would be considered distinct species were it not for the connecting forms. It is a rare species at Vincentown, and we can not state whether the American type is constant or not. The one described agrees very closely with Professor Reuss's figure.

NODOSARIA SPINULOSA (Montagu).

Nautilus spinulosus Montagu, 1808; Test. Brit. Suppl., p. 86, Pl. XIX, fig. 5.
Dentalina spinulosa Sherborn and Chapman, 1886; Jour. Roy. Microsc. Soc., ser. 2, Vol. VI, p. 751, Pl. XV, fig. 13.

Test slightly arcuate, elongate; surface marked by elevated rib-like spines, which cover the segments irregularly. These rib-like projections jut out prominently, especially on the posterior portion of each segment. Chambers somewhat constricted, ten or more in number on long specimens.

Length, 2.16 mm.

Locality.—Manasquan formation, Vincentown, New Jersey.

Geological distribution.—Upper Cretaceous and Tertiary.

The specimens described by Professors Chapman and Sherborn were from the London clay.

NODOSARIA VERTEBRALIS (Batsch).

Nautilus (*Orthoceras*) *vertebralis* Batsch, 1791; Conch. Seasands, p. 3, No. 6, Pl. II, fig. 6, b.
Dentalina vertebralis Sherborn and Chapman, 1886; Jour. Roy. Microsc. Soc., ser. 2, Vol. VI, p. 752, Pl. XIV, fig. 39, *a*, *b*.

Test long, nearly straight; surface marked by slightly elevated longitudinal costæ, very slightly twisted; chambers eight in number, of uniform size, but tapering somewhat toward the primordial segment, unconstricted and marked by rather wide, straight transverse septa; aperture central, mammillate.

Length, 2.4 mm.

Locality.—Rancocas formation, New Egypt, New Jersey.

Geological distribution.—Cretaceous to Recent.

Dr. Anthony Woodward describes this species from Stratton's marl pit, near Mullica Hill, where it occurs in the shell layer of the green marl, and also from Timber Creek, in the lime-sand bed; but it is not a common form in either locality.

NODOSARIA WILLIAMSI Bagg.

Plate III, figs. 2a, 2b.

Nodosaria williamsi Bagg, 1895; Johns Hopkins Univ. Circulars, No. 121, October, 1895, No. 59.

Test small, oval or elliptical, similar to *Nodosaria comata* Batsch, but differing from that species in the arrangement of the costæ, which in our specimens extend the entire length of the shell, while in the former species the oral end is smooth. The costæ are very numerous, fine; chambers three or four, large, inflated, scarcely discernible by the transverse septa; unconstricted at the septal nodes; ultimate chamber truncate; aperture very large, rotund.

Length, 1.13 mm.

Locality.—Rancocas formation, southeast Swedesboro, New Jersey. Rare.

Geological distribution—Upper Cretaceous.

NODOSARIA ZIPPEI Reuss.

Plate III, fig. 1 (aberrant form).

Nodosaria zippei Reuss, 1844; Geogn. Skizze Böhm, Vol. II, pt. 1, p. 210.

Nodosaria zippei Reuss, 1845–[illegible]; Verstein. böhm. Kreide, pt. 1, p. 25, Pl. VIII, figs. 1–3.

Dentalina pulchra Gabb, 1860; Jour. Acad. Nat. Sci., Philadelphia, n. s., Vol. IV, p. 402, Pl. LXIX, figs. 40, 41.

Nodosaria raphanistrum Woodward, 1894; Jour. N.Y. Microsc. Soc., Vol. X, No. 4, p. 110.

Test straight, or but slightly arcuate, very large and long, sometimes reaching 10 millimeters in length; chambers numerous, becoming more distinct toward the ultimate chamber; primordial segment slightly larger than the one succeeding, mucronate; surface of shell marked by from seven to fourteen (usually about twelve) very prominent costæ, only part of which extend the whole length of the shell; ultimate chamber slightly prolonged; aperture rotund.

Length, 9 mm. and over. Small specimens, 3.2 mm.; breadth, 0.5–1 mm.

Locality.—Matawan formation, Marshalltown, New Jersey; Monmouth formation, Freehold, New Jersey; Rancocas formation, Blue Ball, Vincentown, Harrisonville, etc., New Jersey; Manasquan formation, Vincentown, New Jersey.

This beautiful species is one of the very largest forms of Foraminifera found in the New Jersey Cretaceous marl beds, and was described by Gabb as early as 1860, under the name *Dentalina pulchra.* Owing to its great length it is very easily broken, so that only a few of the largest specimens are perfect. It was very well described by Reuss in 1844 (loc. cit.), who said that its length was sometimes 1½ inches, the number of chambers twenty to thirty, the costæ seven to fourteen, and that there were secondary riblets occasionally set in between the main costæ and running a short distance along the surface of the shell.

Reuss also pointed out the similarity of *Nodosaria septemcostata* and *N. undecimcostata* Geinitz, and considered the two latter as identical with *N. zippei*. Dr. Anthony Woodward considers this species identical with *N. raphanistrum*, but the two species are sufficiently distinct to justify the retention of the original name given by Professor Reuss.

This species has a very wide geological range and distribution in the Cretaceous, and occurs in every marl bed of New Jersey.

In the large amount of material examined in the preparation of this report an interesting case of dimorphism was observed in one of the specimens of *Nodosaria zippei*. The shell which has been previously referred to begins as a textularian with two chambers side by side, each bearing the same number of costæ as the original form and united above into a straight typical nodosarian chamber. It was found in the green marl of Blue Ball, where the Nodosariæ are so perfectly preserved that mucronate forms still retain their spines in almost perfect condition.

Genus LINGULINA d'Orbigny.

LINGULINA CARINATA d'Orbigny.

Lingulina carinata d'Orbigny, 1826; Ann. Sci. Nat., Vol. VII, p. 257, No. 1.
Lingulina carinata Brady, 1884; Chal. Rept., Vol. IX, p. 517, Pl. LXV, fig. 16, 17.

Test elliptical, elongate, laterally compressed; surface smooth and glistening; shell consisting of six somewhat extended chambers, separated by arched septa; peripheral margin obtusely angular; chambers increasing rapidly in size toward the distal end and marked by distinct transverse septal lines; primordial chamber circular, not elevated; aperture a narrow terminal slit.

Length, 1.2–1.85 mm.; breadth, 1–1.3 mm.

Locality.—Rancocas formation, Vincentown, New Jersey.

Geological distribution.—Cretaceous to Recent.

This beautiful little species is common in the lime sand at Vincentown. It resembles *Lingulina bohemica* Reuss both in its lateral compression and in its external form, but is distinguished from that form by its broader elliptical outline and in having invariably six chambers instead of five.

Genus FRONDICULARIA Defrance.

FRONDICULARIA ALATA d'Orbigny.

Plate II, fig. 4b (bottom form).

Frondicularia alata d'Orbigny, 1826; Ann. Sci. Nat., Vol. VII, p. 256, No. 2.
Frondicularia alata Brady, 1884; Chal. Rept., Vol. IX, p. 522, Pl. LXV, figs. 20–23; Pl. LXVI, figs. 3–5.

Test broadly oval, large, complanate; surface smooth, marked by fairly distinct septal lines; chambers narrow, numerous, arched; pri-

mordial segment oval, elevated, situated a little within the periphery; basal portion of shell more or less covered by spinous projections, which are either single or united.

Length, 4.34 mm.; breadth, 3 mm.

Locality.—Rancocas formation, Vincentown, Brownsville, etc., New Jersey.

Geological distribution.—Cretaceous to Recent.

This form is rather common in many localities where the lime sand is developed.

FRONDICULARIA ANGUSTA (Nilsson) var. DIMIDIA Bagg.

Plate III, figs. 7a, 7b.

Planularia angusta Nilsson, 1827; Petref. Suec. p. 11, Pl. IX, fig. 22 a, A.
Frondicularia angusta Reuss, 1845–46; Verstein, böhm. Kreide, pt. 1, p. 29, Pl. VIII, figs. 13, 14.

Test lanceolate, very elongate, strongly compressed and leaf-like; consisting of from ten to twelve chambers, which gradually increase in size toward the proximal end, where the greatest breadth occurs; primordial chamber spherical, elevated, mucronate, and the surface marked by three sharply defined ribs; surface of shell marked by numerous fine longitudinal lines, running nearly parallel to the lateral edges; septa distinct, slightly raised externally as ridges; aperture normally round, terminal.

Length, 2.6 mm.; breadth, 1 mm.

Locality.—Rancocas formation, Vincentown, New Jersey.

Geological distribution.—Cretaceous.

This species is very closely allied to the European form, but differs principally in the number of chambers, which is invariably less than one-half of those of the former type. It is common in the lime sand at Vincentown.

FRONDICULARIA ARCHIACIANA d'Orbigny, var. STRIGILLATA, nov. var.

Plate III, fig. 5.

Frondicularia archiaciana d'Orbigny, 1840; Mém. Soc. géol. France, ser. 1, Vol. IV, p. 20, Pl. I, figs. 34–36.
Frondicularia archiaciana Brady, 1884; Chal. Rept., Vol. IX, p. 520, Pl. CXIV, fig. 12.

Test elongate, complanate, anteriorly acute, posteriorly obtuse, and provided with a short spine; chambers, six to eight, relatively large, equally compressed, and slightly limbate at the lateral edges; surface marked by definite elevated striæ, of which the two central rows are more prominent than those near the margin; primordial chamber globular; ultimate chamber prolonged, tube-like; aperture small, rotund.

Length, 1.6 mm.; breadth, 0.6 mm.

Locality.—Rancocas formation, Vincentown, New Jersey.

Geological distribution.—Cretaceous to Recent.

FRONDICULARIA CLARKI Bagg.

Plate III, fig. 4.

Frondicularia clarki Bagg, 1895; Johns Hopkins Univ. Circulars No. 121, October.

Test complanate, smooth, very elongate oval in outline; consisting of from twelve to fourteen narrow parallel chambers; primordial chamber bulbous, elevated, costate, mucronate; ultimate chamber elongate, bearing upon one surface a hollow, somewhat extended tube, which forms an elevated median ridge with rather angular edges, and extends for a short distance down the shell. This tube terminates anteriorly in the nearly rotund aperture.

Length, 3.4 mm.; breadth, 0.9 mm.

Locality.—Monmouth formation, Atlantic Highlands, New Jersey. Very rare.

Geological distribution.—Cretaceous.

I have named this interesting species after my friend and instructor, Prof. William B. Clark.

FRONDICULARIA GAULTINA Reuss.

Frondicularia gaultina Reuss, 1860; Sitz. Akad. Wiss. Wien, Vol. XL, p. 194, Pl. V, fig. 5.

Test rather narrow, smooth, very elongate, compressed; consisting of numerous chambers, gradually increasing in size from below upward; septal lines approximately straight, paralleled, depressed; shell broadest nearer the ultimate segment, gradually diminishing below; primordial segment not preserved.

Length unknown.

Locality.—Matawan formation, Marshalltown, New Jersey. Rare.

Geological distribution.—Cretaceous.

FRONDICULARIA INVERSA Reuss.

Frondicularia inversa Reuss, 1844; Geogn. Skizze Böhm., Vol. II, pt. 1, p. 211.
Frondicularia inversa Reuss, 1845–46; Verstein. böhm Kreide, pt. 1, p. 31, Pl. VIII, figs. 15–19; Pl. XIII, fig. 42.

Test complanate, leaf-like, elongate, smooth, broadest near the middle, tapering at the sides toward the anterior and posterior ends by straight wedge-shaped lateral margins; peripheral edges square; one lateral surface slightly curved along the median line, opposite surface approximately flat; chambers ten to twelve, narrow, elongate, nearly parallel to upper peripheral edges; primordial chamber oval, elevated, marked by a median ridge, mucronate; aperture rotund, crenulated.

Length, 2.82 mm.; breadth, 1 mm.

Locality.—Monmouth formation, Freehold, New Jersey. Rare.

Geological distribution.—Cretaceous.

FRONDICULARIA LANCEOLA Reuss.

Frondicularia lanceola Reuss, 1865; Reuss's Model No. 23 (Catalogue No. 46, 1851).

Test very elongate, lanceolate, tapering sharply to an acute point at the primordial end; segments numerous, twelve or more, quadrangular in cross section; septa depressed sharply, so that the chambers appear elevated into oblique folds; surface smooth and glistening; peripheral margin limbate; ultimate chamber extended into a distinct tube, which carries the oral aperture; primordial chamber nearly circular, not elevated; aperture radiate.

Length, 3 mm.; breadth, 0.6 mm.

Locality.—Monmouth formation, Freehold, New Jersey.

Geological distribution.—Cretaceous.

I have only one specimen of this beautiful form.

FRONDICULARIA MAJOR Bornemann.

Plate III, fig. 3.

Frondicularia major Bornemann, 1854; Liasform, Göttingen, p. 36, Pl. III, figs. 21 a–c.

Test smooth, compressed, somewhat thicker along the median line, thinner at the peripheral margins, which are neatly rounded; chambers varying from four to nine; somewhat convex forward; septal lines distinct; posterior margin obtusely rounded; anterior acuminate; aperture a central radiate opening.

Length, 1–4 mm.; breadth, 1.6 mm.

Locality.—Rancocas formation, Vincentown, New Jersey.

Geological distribution.—Lias to Cretaceous.

FRONDICULARIA OVATA Roemer.

Plate II, figs. 4a, 5b (bottom forms), and Plate IV, figs. 2a, 2b.

Frondicularia ovata Roemer, 1840; Verstein, norddeutsch. Kreid., p. 96, Pl. XV, fig. 9.

Test ovate, complanate, smooth; consisting of a small number of parallel chambers, which are distinct and marked very slightly at t e lower peripheral edges by the septal endings; primordial chamber flat, basal; ultimate chamber large, slightly prolonged into the rounded aperture; peripheral margins rather squarely set off.

Length, 9.82 mm.

Locality.—Matawan formation, Marshalltown, New Jersey; Rancocas formation, Vincentown, New Jersey.

Geological distribution.—Cretaceous.

FRONDICULARIA PULCHELLA Karrer.

Frondicularia pulchella Karrer, 1870; Jahrb. k. k. geol. Reichsanstalt, Vol. XX, p. 171, Pl. 1, fig. 8.

Test large, elongated, complanate; surface smooth, marked by rather

distinct septal lines, which separate the narrow, extended, parallel chambers; greatest width near the middle of the shell, thence tapering rather sharply toward both extremities, but the lower portion slightly incurved, while the anterior end is slightly outcurved, though not markedly so; primordial segment lost.

Length, about 5 mm.; breadth (central), 1.8 mm.

Locality.—Matawan formation, Marshalltown, New Jersey.

Geological distribution.—Cretaceous.

FRONDICULARIA RETICULATA (Reuss).

Plate III, fig. 6.

Flabellina reticulata Reuss, 1850; Haidinger's Nat. Abhandl., Vol. IV, pt. 1, p. 30, Pl. I, fig. 22.

Test thin, leaf-like, broad at the center, but tapering rapidly toward the oral end; consisting of ten rather narrow, elongated chambers, the surfaces of which are marked transversely by numerous delicate costæ, which run from septum to septum, and completely cover the whole form like a network; primordial chamber nearly circular, but not elevated, very slightly eccentric, yet not enough to justify its being placed among flabelline types.

Length, 0.87 mm.; greatest breadth, 0.88 mm.

Locality.—Monmouth formation, Freehold, New Jersey.

Geological distribution.—Cretaceous.

This is one of the most beautiful of all frondicularians, and is at the same time exceedingly rare. We have only one specimen from the Lower Marl at Freehold, and it is interesting to note that Professor Reuss records the single occurrence of a perfect specimen from the Kreidemergel of Lemberg.

FRONDICULARIA VERNEUILINA d'Orbigny.

Frondicularia verneuilina d'Orbigny, 1840; Mém. Soc. géol. France, ser. 1, Vol. IV, p. 20, Pl. I., figs. 32, 33.

Test elongate elliptical; peripheral margins gracefully curved, broadest near the center, not compressed laterally as much as most Frondicularia; chambers relatively large, few; primordial segment globose, costate, mucronate, distinctly set off from the succeeding chamber; ultimate chamber prolonged into a tubular neck, which carries the little round aperture.

Length, 1.5 mm.

Locality.—Matawan formation, Marshalltown, New Jersey.

Geological distribution.—Cretaceous.

Genus RHABDOGONIUM Reuss.

RHABDOGONIUM ROEMERI Reuss.

Rhabdogonium roemeri Reuss, 1860; Sitz. Akad. Wiss. Wien., Vol. XL, p. 201, Pl. VI, fig. 7.

Test coarsely arenaceous, partly composed of glauconite grains, elongate, straight, or slightly bent, sharply triangular, obtusely rounded and slightly angular at the ends; peripheral margin curved, sharp; chambers few in number, usually six, short, separated by arched depressed septa; aperture elliptical, placed centrally at the distal end.

Length, 1.5 mm.

Locality.—Matawan formation, Freehold, New Jersey.

Geological distribution.—Cretaceous.

RHABDOGONIUM TRICARINATUM (d'Orbigny).

Vaginulina tricarinata d'Orbigny, 1826; Ann. Sci. Nat., Vol. VII, p. 258, No. 4; Modèle, No. 4.

Rhabdogonium pyramidale Karrer, 1861; Sitz. Akad. Wiss. Wien, Vol. XVI, p. 19, Pl. I, fig. 34.

Rhabdogonium tricarinatum Brady, 1884; Chal. Rept., Vol. IX, p. 525, Pl. LXVII, figs. 1-3.

Test triangular, elongated and gradually tapering toward both extremities; peripheral margins sharp, becoming slightly twisted below; anterior end prolonged into a tube-like neck; chambers about ten, narrow, arched, and separated by curved septa; aperture rotund.

Length, 2.6 mm.

Locality.—Rancocas formation, Brownsville, New Jersey.

Geological distribution.—Cretaceous to Recent.

RHABDOGONIUM TRICARINATUM var. ACUTANGULUM Reuss.

Rhabdogonium tricarinatum var. *acutangulum* Reuss, 1862 (1863); Sitz. Akad. Wiss. Wien, Vol. XLVI, Abth. 1, p. 55, Pl. IV, fig. 14, a, b.

Test small, trihedral, coarsely arenaceous; the three marginal angles sharp and distinct; chambers few, short, separated by somewhat arched septa, not very distinct externally; primordial end sharp, anterior obtusely angular; aperture triangular, with incurved lateral edges.

Length, 1.73 mm.

Locality.—Matawan formation, Marshalltown, New Jersey.

Geological distribution.—Cretaceous.

Genus MARGINULINA d'Orbigny.

MARGINULINA ENSIS Reuss.

Marginulina ensis Reuss, 1845-46; Verstein. böhm. Kreide, pt. 1, p. 29, Pl. XII, fig. 13; Pl. XIII, figs. 26, 27; pt. 2, p. 106, Pl, XXIV, fig. 30.

Nodosaria communis Woodward, 1894; Jour. N. Y. Microsc. Soc., Vol. X, No. 4, p. 103.

Test elongate, moderately compressed, oval or elliptical in trans-

verse section; shell variable in outline, either nearly straight throughout its whole length or incurved; septa very slightly oblique, directed toward the primordial chamber, apparent externally as ridges; proximal chambers more involute than in *Marginulina elongata;* chambers numerous, apparent externally; ultimate chamber somewhat prolonged, and ending posteriorly in a short tube; aperture rotund, with crenulated margin.

Length.—1.3, 1.73 mm.; breadth, 0.43 mm.

Locality.—Monmouth formation, Bruere's pits on Crosswicks Creek; Rancocas formation, Blue Ball, Mullica Hill, New Egypt, New Jersey.

Geological distribution.—Cretaceous.

Professor Sherborn prefers to change the word Marginulina to Cristellaria for this species, thus making it *Cristellaria ensis* (Reuss). The writer prefers to leave it under the original name of Professor Reuss.

MARGINULINA PEDIFORMIS Bornemann.

Marginulina pediformis Bornemann, 1855; Zeitsch. d. geol. Gesell., Vol. VII, p. 326, Pl. XIII, fig. 13.

Marginulina pedum d'Orbigny, 1846; Foram. Foss. Bassin tert. Vienne, p. 68, Pl. III, figs. 13, 14.

Test smooth, short, circular in transverse section; consisting of about six chambers, of which the first two or three are inrolled and rounded at the base; segments becoming more definite above; ultimate chamber largest and slightly prolonged; aperture small, rotund, crenulate; septa depressed, slightly oblique, though not markedly so.

Length, 1 mm.

Locality.—Matawan formation, Marshalltown, New Jersey.

Geological distribution.—Cretaceous, Tertiary.

MARGINULINA TRILOBATA d'Orbigny.

Marginulina trilobata d'Orbigny, 1840; Mém. Soc. géol. France, ser. 1, Vol. IV, p. 16, Pl. I, figs. 16, 17.

Test elongate, smooth, and glistening, compressed laterally, slightly arcuate at the primordial end; somewhat tapering; chambers short, oval, regular, numerous, ten to sixteen, slightly constricted; surface marked by small, distinct, elliptical ridges, giving the form a peculiar trilobed appearance, whence its name; primordial chamber small, nearly spherical; septal lines depressed; aperture small, radiate.

Length, 4 mm. in large specimens; breadth, 0.6 mm.

Locality.—Matawan formation, Marshalltown, New Jersey; Monmouth formation, Freehold, New Jersey.

Geological distribution.—Cretaceous.

Genus VAGINULINA d'Orbigny.

VAGINULINA LEGUMEN (Linné).

Plate IV, fig. 4.

Nautilus legumen Linné, 1758; Syst. Nat., tenth ed., p. 711, No. 248; 1767, twelfth ed., p. 1164, No. 288.

Vaginulina legumen Terrigi, 1891; Memoire R. Com. g. Regno, Vol. IV, pt. 1, p. 94, Pl. III, fig. 6.

Test straight or nearly so, smooth, compressed laterally, pod-like; consisting of only six or seven chambers; septa nonlimbate, oblique, parallel, not very distinct externally; ultimate chamber slightly prolonged upon one side and carrying the small radiate aperture.

Length, 1.3 mm; breadth, 0.47 mm.

Locality.—Matawan formation, Marshalltown, New Jersey; Rancocas formation, Vincentown, New Egypt, Mullica Hill, New Jersey.

Geological distribution.—Trias to Recent.

The above species has been lately described from the Alabama chalk by Dr. Woodward. It is a beautiful little shell, of snow-white color, and is rather rare.

VAGINULINA STRIGILLATA Reuss.

Plate IV, fig. 3.

Citharina strigillata Reuss, 1845–46; Verstein. böhm. Kreide, pt. 2, p. 106, Pl. XXIV, fig. 29.

Vaginulina strigillata and var. Jones and Parker, 1860; Quart. Jour. Geol. Soc., Vol. XVI, Pl. XX, figs. 29–35.

Test complanate, leaf-like, very large, roughly triangular; surface smooth, marked by slightly elevated septal lines; chambers numerous, often as many as twenty-five, narrow, parallel, slightly oblique, becoming constricted toward the curved margin and passing rapidly downward toward the proximal end, where the septal lines finally appear only as fine ridges. As a result of this constriction of the chambers at the curved margin, transverse sections show only four or five chambers. Along the straight edge run three elevated, rounded costæ, with sometimes one or two smaller ones between. The latter, however, do not extend the whole length of the shell as do the ridges. Septal lines distinct, slightly crenate, becoming much thickened toward the straight edge of the shell; primordial chamber oval, elevated, slightly mucronate, covered by numerous costæ.

Length, 3–9 mm; breadth, 2.3 mm.

Locality.—Monmouth formation, Freehold, New Jersey.

Geological distribution.—Cretaceous.

This species is very common in the lower marl of Freehold, but I have not found it elsewhere.

CRISTELLARIA Lamarck.

CRISTELLARIA ACUTAURICULARIS (Fichtel and Moll).

Nautilus acutauricularis Fichtel and Moll, 1803; Test. Micros., p. 102, Pl. XVIII; figs. *g–i*.

Cristellaria navicula d'Orbigny, 1840; Mém. Soc. géol. France, Vol. IV, ser. 1, p. 27, Pl. II, figs. 19, 20.

Cristellaria acutauricularis Brady, 1884; Chal. Rept., Vol. IX, p. 543, Pl. CXIV, fig. 17 *a*, *b*.

Test involute, thick, convex, smooth; septal plane broad, triangular, nearly flat; chambers seven or eight, weakly curved; keel acute carinate; aperture nipple-shaped, situated at the extremity of the convex side.

Length, 1.43 mm.; breadth, 0.65 mm.

Locality.—Rancocas formation, Timber Creek, Vincentown, New Jersey.

Geological distribution.—Lias (?), Cretaceous to Recent.

CRISTELLARIA ARTICULATA (Reuss).

Robulina articulata Reuss, 1863; Sitz. Akad. Wiss. Wien, Vol. XLVIII, p. 53, Pl. V, fig. 62.

Cristellaria articulata Brady, 1884; Chal. Rept., Vol. IX, p. 547, Pl. LXIX, figs. 10–12, also 1–4.

Test nearly circular, smooth, thickened, flattened at the sides; obtusely angular peripheral margin; chambers six or seven, broadly triangular, separated by depressed septa; aperture oval, surrounded by a fissured border.

Diameter, 1.3 mm.

Locality.—Rancocas formation, Vincentown, Mullica Hill, Timber Creek, New Jersey.

Geological distribution.—Cretaceous to Recent.

Professor Brady considers this species a thick variety of *Cristellaria rotulata*.

CRISTELLARIA CASSIS (Fichtel and Moll).

Nautilus cassis Fichtel and Moll, 1798; Test. Micros., p. 95, var. *α*, Pl. XVII, fig. *a–d*; var. *β*, Pl. XVII, fig. *e–g*; var. *γ*, Pl. XVII, figs. *h–i*; var. *δ*, Pl. XVII, figs. *k*, *l*; var. *ε*, Pl. XVIII, figs. *a–c*.

Cristellaria cassis Brady, 1884; Chal. Rept., Vol. IX, p. 552, Pl. LXVIII, fig. 10.

Test very large, complanate, elongate oval, distinctly carinate; chambers irregular, ten to fifteen in final volution; septa distinct, arcuate, depressed; aperture oval with crenulated margin.

Length, 4.3–4.56 mm.; breadth, 3–4 mm.

Locality.—Rancocas formation, Vincentown, Brownsville, New Egypt, etc., New Jersey.

Geological distribution.—Cretaceous to Recent.

CRISTELLARIA CREPIDULA (Fichtel and Moll).

Nautilus crepidula Fichtel and Moll, 1803; Test Micros., p. 107, Pl. XIX, figs. *g–i*.
Cristellaria crepidula d'Orbigny, 1839; Foram. Cuba, p. 64, Pl. VIII, figs. 17, 18.

Test elongate, arcuate, smooth, compressed, pellucid; chambers ten to twelve, oblique, separated by slightly convex walls; posterior chambers involute, anterior chambers evolute; aperture rotund, slightly crenate.

Length, 0.7 mm; breadth, 0.26 mm.

Locality.—Rancocas formation, Vincentown, Mullica Hill, New Jersey.

Geological distribution.—Lias to Recent.

The above form is not a common species. Our specimens are similar in shape to *Cristellaria intermedia* Reuss, which is considered as identical with the above by Professor Brady.

CRISTELLARIA CRETACEA Bagg.

Plate V, figs. 2a, 2b.

Test complanate, smooth, elongate, oval, resembling *Cristellaria cassis* in general contour, but differing from that species in the absence of the marginal keel; margin rounded; chambers numerous, about twelve in final convolution, narrow, elongated; septa distinct, convex; ultimate chamber truncate, anterior margin straight; aperture small, narrow elliptical, with crenulated margin.

Length, 4.3 mm.; breadth, 3 mm.

Locality.—Rancocas formation, Vincentown, New Jersey. Common.

Geological distribution.—Cretaceous.

The above species is less elongated than *Cristellaria projecta*, which it resembles closely.

These two forms, together with *Cristellaria cassis*, are rather abundant at Vincentown, and all attain an enormous size for the type.

CRISTELLARIA CULTRATA (Montfort).

Plate VI, fig. 1.

Robulus cultratus Montfort, 1808; Conch. Syst., Vol. I, p. 214, 54e genre.
Robulina cultrata d'Orbigny, 1846; Foram. Foss. Bassin tert. Vienne, p. 96, Pl. IV, figs. 10–13.

Test circular, biconvex, smooth and glistening, peripheral margin sharp, broadly keeled; chambers seven to eleven, in final convolution, somewhat convex, smooth or costate; aperture radiate.

Diameter, 1–2 mm.

Locality.—Monmouth formation, Freehold, Bruere's pits, on Crosswicks Creek, Marlboro, New Jersey; Rancocas formation, Mullica Hill, New Egypt, Swedesboro, Timber Creek, New Jersey.

Geological distribution.—Cretaceous to Recent.

This species is common at Freehold and is beautifully preserved. The width of the marginal keel is variable, as is also the number of chambers. It is similar to *Cristellaria rotulata*, with the addition of the keel. Specimens of *Cristellaria cultrata* from New Egypt and Swedesboro are not smooth, as in typical forms, but are marked externally by raised septa.

CRISTELLARIA GIBBA d'Orbigny.

Cristellaria gibba d'Orbigny, 1839; Foram. Cuba, p. 63, Pl. VII, figs. 20, 21.

Test oblong, biconvex, smooth, subcarinate, narrow; chambers few (seven or eight), slightly arcuate, separated by distinct septa; aperture marginate.

Length, 1.3 mm.; breadth, 0.87 mm.

Locality.—Rancocas formation, Vincentown, Mullica Hill, Timber Creek, New Jersey.

Geological distribution.—Cretaceous to Recent.

CRISTELLARIA ITALICA (Defrance).

Plate IV, figs. 5a, 5b.

Sarecenaria italica Defrance, 1824; Dict. Sci. Nat., Vol. XXXII, p. 177; Vol. XLVII, p. 344; Atlas Conch., Pl. XIII, fig. 6.

Cristellaria italica, Brady, 1884; Chal. Rept., Vol. IX, p. 544, Pl. LXVIII, figs. 17, 18, 20–23.

Test elongate, trihedral, planospiral segments few, succeeding chambers five or six, arranged in a nearly straight superimposed series; dorsal margin sharp, noncarinate; transverse section triangular, segments short, slightly oblique, inclined anteriorly toward initial end.

Length, 1 mm.

Locality.—Rancocas formation, Swedesboro, Blue Ball, Mullica Hill, New Jersey.

Geological distribution.—Cretaceous to Recent.

This is not a common species. It bears some resemblance to *Cristellaria acutauricularis*, but is more elongate, and the anterior edge is more erect. Another species, closely allied to the above form, is *Marginulina triangularis* d'Orbigny.[1]

CRISTELLARIA MAMILLIGERA Karrer.

Cristellaria mamilligera Karrer, 1864; Novara Exped. Geol., Vol. I, pt. 2, p. 76, Pl. XVI, fig. 5.

Cristellaria mamilligera Brady, 1884; Chal. Rept., Vol. IX, p. 553, Pl. LXX, figs. 17, 18.

Test complanate, nearly circular; anterior margin truncate, posterior margin slightly carinate; surface ornamented with a number of large raised ridges and tubercles in the umbilical region; septa depressed, the depressions partially filled by exogenous material which forms the

[1] Foram. Foss. Bassin tert. Vienne, 1846, p. 71, Pl. III, figs. 22, 23.

ridges; chambers large, slightly arcuate, eight or nine in the final convolution; septal plane narrow, surrounded by a definite border; aperture an elongate-oval opening surrounded by a crenulated margin.

Diameter, 1.74 mm.

Locality.—Rancocas formation, Blue Ball, New Jersey.

Geological distribution.—Cretaceous to Recent.

This species is very rare in the green marl of Blue Ball, and has not been recognized elsewhere.

CRISTELLARIA MEGAPOLITANA Reuss.

Robulina megapolitana Reuss, 1855; Zeits. d. geol. Gesell., Vol. VII, p. 272, Pl. IX, fig. 5.

Test circular, compressed, smooth and glistening, keeled and with more or less definite flange. There are seven or eight strongly curved chambers apparent externally as raised lines, which are thicker at the umbilicus, but become attenuated toward the peripheral margin. Umbilical disk more or less distinct. Septal plane triangular, with raised border.

Length, 1–1.5 mm.

Locality.—Monmouth formation, Freehold, New Jersey.

Geological distribution.—Cretaceous.

CRISTELLARIA PROJECTA Bagg.

Plate V, figs. 1a, 1b.

Cristellaria projecta Bagg, 1895; Johns Hopkins Univ. Circulars, No. 121, October, 1895.

Test greatly elongated, complanate, smooth, consisting of two and one-half convolutions; chambers numerous, twenty or more in the last volution, arcuate, narrow, elongate; ultimate chamber nearly at right angles to umbilicus; margin rounded; septal lines very slightly depressed; aperture elliptical.

Length, 5.3 mm.; breadth, 2.7 mm.

Locality.—Rancocas formation, Vincentown, New Jersey.

Geological distribution.—Cretaceous.

This is a rare form in the lime sand at Vincentown, and has not been found elsewhere.

CRISTELLARIA ROTULATA (Lamarck).

Lenticulites rotulata Lamarck, 1804; Annales du Mus., Vol. V, p. 188, No. 3.
Cristellaria rotulata d'Orbigny, ser. 1, 1840; Mém. Soc. géol. France, Vol. IV, p. 26, Pl. II, figs. 15–18.

Test involute, biconvex, smooth; peripheral edge sharp, noncarinate; chambers numerous, but only eight or nine in final solution; septa moderately curved, visible externally as fine lines; aperture elliptical, radiate.

Diameter, 1–2 mm.

Locality.—Rancocas formation, Vincentown, Blue Ball, New Egypt, Mullica Hill, Timber Creek, etc., New Jersey; Manasquan formation, Vincentown, New Jersey.

Geological distribution.—Triassic to Recent.

This is one of the most common forms in the lime-sand bed, and is especially plentiful at Vincentown. The size of the shell is very variable, some of the largest specimens being more than 2 millimeters in diameter.

CRISTELLARIA SECANS Reuss.

Cristellaria secans Reuss, 1859 (1860); Sitz. Akad. Wiss. Wien, Vol. XL, p. 214, Pl. IX, fig. 7.

Test circular, laterally compressed, sharply keeled on the peripheral margin; umbilical disc prominent and septa radiating from this in gently curving lines; about ten small triangular chambers in the last convolution.

Diameter, 1.5 mm.

Locality.—Monmouth formation, Freehold, New Jersey.

Geological distribution.—Cretaceous.

CRISTELLARIA TRACHYOMPHALA (Reuss).

Robulina trachyomphala Reuss, 1850; Haidinger's Nat. Abhandl., Vol. IV, pt. 1, p. 34, Pl. III (error for II), fig. 12.

Test rounded, compressed, with angular periphery; umbilical disc raised, nearly round, more marked in some forms than in others; septal lines distinct, convex. There are from eight to ten chambers in the last whorl. Aperture a triangular-shaped opening surrounded by a raised crenulated margin at the external edge of the ultimate segment.

Diameter, 0.86–1.3 mm.

Locality.—Rancocas formation, Blue Ball, New Jersey.

Geological distribution.—Cretaceous.

CRISTELLARIA TRIANGULARIS d'Orbigny.

Cristellaria triangularis d'Orbigny, 1840; Mém. Soc. géol. France, ser. 1, Vol. IV, p. 27, Pl. II, figs. 21, 22.

Cristellaria triangularis Reuss, 1845–46; Verstein. böhm. Kreide, pt. 1, p. 34, Pl. VIII, fig. 48.

Test triangular, very convex, smooth; periphery sharply carinate; lateral surfaces somewhat concave; chambers few, six or seven, large, evolute, superposed; septa oblique, very slightly convex anteriorly; septal plane broadly triangular; aperture radiate.

Length, 1 mm.

Locality.—Monmouth formation, Freehold, New Jersey.

Geological distribution.—Cretaceous.

The occurrence of this species from the craie blanche of the Paris basin, France, was recorded by d'Orbigny as early as 1840. I have found but two specimens in the lower marl of Freehold.

CRISTELLARIA WETHERELLII (Jones).

Marginulina wetherellii Jones, 1854; Morris Catalogue, Brit. Foss., ed. 2, p. 37.
Cristellaria wetherellii Brady, 1884; Chal. Rept., Vol. IX, p. 537, Pl. CXIV, fig. 14.

Test elongate, pod-like, compressed; primordial segments spiral, ultimate segments straight, evolute; surface marked by large tubercles more or less regular and crossing the shell surface like septal ridges; aperture round, at the end of a somewhat prolonged neck.

Length, 1.56 mm.; breadth, 0.5 mm.

Locality.—Rancocas formation, Vincentown, Mullica Hill, Timber Creek, New Jersey.

Geological distribution.—Cretaceous to Recent.

The above species is rare at Vincentown. Dr. Woodward states that it is rare at Mullica Hill, but common at Timber Creek.

Genus FLABELLINA d'Orbigny.

FLABELLINA CORDATA Reuss.

Flabellina cordata Reuss; Verstein. böhm. Kreide, pt. 1, p. 32, Pl. VIII, figs. 37–46, 78.
Flabellina cordata Reuss, 1854; Denks. Akad. Wiss. Wien, Vol. VII, p. 67, Pl. XXV, figs. 6–8.

Test broadly ovate or heart-shaped, complanate, with numerous narrow, elongated chambers; primordial chamber somewhat elevated and more or less globular, succeeding chambers at first flabelline, later Frondicularia-like; anterior extremity wedge-like with gently curving sides, posterior border much wider than in *Flabellina sagittaria* and differing from that species in the irregularity of the basal margin caused by the extension of the primordial chamber; surface of test smooth and glistening; aperture a small radiate, terminal opening.

Length, 1.8–4 mm.

Locality.—Rancocas formation, Vincentown, Brownsville, New Jersey.

Geological distribution.—Cretaceous.

FLABELLINA SAGITTARIA (Lea).

Plate IV, figs. 1a, 1b.

Palmula sagittaria Lea, 1833; Contributions to Geol., pp. 219–220, Pl. VI, fig. 228.
Planularia cuneata Morton, 1842; Jour. Acad. Nat. Sci., Philadelphia, Vol. VIII, pt. 2, p. 214, Pl. XI, fig. 5.

Test complanate, broadly elliptical (sometimes rather narrow and more elongate), occasionally slightly convex along the median line, while the opposite side is concave, though in typical specimens both surfaces are flat; septa distinct, forming a sharp median angle;

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chambers numerous, the number dependent somewhat upon the size of the individual; peripheral margins moderately rounded; primordial chamber bulbous, mucronate, or more usually smooth; surface smooth and glistening; aperture typically mammillate, though frequently the shell is worn or broken off so that a round opening appears.

Length, 1–9 mm.; breadth, 1–4.3 mm.

Locality.—Rancocas formation, Vincentown, Blue Ball, New Egypt, Brownsville, etc., New Jersey.

Geological distribution.—Cretaceous.

This species is one of the most common forms at Vincentown. It is very variable in size and shape and is found in all stages of growth. As has been previously stated, it was the first Foraminifera to be described from the New Jersey greensands. (Lea, loc. cit.)

Subfamily POLYMORPHININÆ.

Genus POLYMORPHINA d'Orbigny.

POLYMORPHINA COMPRESSA d'Orbigny.

Polymorphina compressa d'Orbigny, 1846; Foram. Foss. Bassin tert. Vienne, p. 233, Pl. XII, figs. 32–34.

Test oblong, compressed, inequilateral; chambers numerous, arranged biserially, somewhat inflated; septal lines depressed, surface smooth; aperture variable, usually simple, circular, and coronate, sometimes labyrinthic or porous.

Length, 3 mm. in large specimens.

Locality.—Rancocas formation, Vincentown, New Jersey.

Geological distribution.—Lias to Recent.

POLYMORPHINA COMMUNIS (d'Orbigny).

Plate VI, fig. 2.

Guttulina communis d'Orbigny, 1826; Ann. Sci. Nat., Vol. VII, p. 266, Pl. XII, figs. 1–4; Modèles, No. 62.

Polymorphina communis, Brady, Parker, and Jones, 1870; Trans. Linn. Soc., London, Vol. XXVII, p. 224, Pl. XXXIX, fig. 10 a b.

Test irregularly ovoidal, or egg-shaped, consisting of about four visible segments; anterior extremity acute; posterior obtuse; surface smooth, with distinct septal depressions; chambers inflated, elliptical, embracing; aperture mammillate.

Length, 1.3–1.4 mm.; breadth, 1–1.3 mm.

Locality.—Rancocas formation, Vincentown, New Jersey. Common.

Geological distribution.—Lias to Recent.

POLYMORPHINA EMERSONI n. sp.

Plate VI, fig. 3.

Test elongate oval, oval end acute, posterior obtusely rounded; surface of test covered completely by fine longitudinal costæ; chambers

two, elongated, oblique, separated by nearly straight septa slightly marked near the posterior end and depressed at the peripheral margin; aperture rotund.

Length, 1.9 mm.

Locality.—Monmouth formation, Freehold, New Jersey.

Geological distribution.—Cretaceous.

This is a very rare species, and has only been obtained in the lower marl of Freehold. I have named it after Prof. B. K. Emerson.

POLYMORPHINA GIBBA (d'Orbigny).

Globulina gibba d'Orbigny, 1826; Ann. Sci. Nat., Vol. VII, p. 266, No. 20; Modèle No. 63.

Polymorphina gibba Brady, Parker, and Jones, 1870; Trans. Linn. Soc. London, Vol. XXVII, p. 216, Pl. XXXIX, fig 2 a–d.

Test subglobular, apex slightly produced, base obtusely rounded; consisting of from two to four chambers, compactly joined and overlapping; surface smooth, unmarked by septal constrictions; septa visible as delicate, oblique lines, laterally very slightly compressed, though usually nearly circular in transverse section; shell larger than *Polymorphina lactea*, less elongated toward the apex; aperture nammillate.

Diameter, 0.5–1.17 mm.

Locality.—Monmouth formation, Freehold, New Jersey; Rancocas formation, Vincentown, New Jersey.

Geological distribution.—Jurassic to Recent.

POLYMORPHINA LACTEA (Walker and Jacob).

Serpula lactea Walker and Jacob, 1798 (fide Kanmacher); Adams's Essays, second ed., p. 634, Pl. XXIV, fig. 4.

Polymorphina lactea Brady, 1884; Chal. Rept., Vol. IX, p. 559, Pl. LXXI, fig 11 (typical), Pl. LXXII, fig. 14 (variety).

Test ovate or subpyriform, only slightly compressed; three or four chambers, scarcely visible externally; aperture terminal, radiate.

Diameter, 0.87 mm.

Locality.—Monmouth formation, Freehold, New Jersey; Rancocas formation, Vincentown, Blue Ball, New Egypt, Timber Creek, etc., New Jersey.

Geological distribution.—Jurassic to Recent.

POLYMORPHINA LACTEA elongate variety Brady.

Polymorphina lactea elongate variety Brady, 1884; Chal. Rept., Vol. IX, p. 559, Pl. LXXI, fig. 14.

Test similar to the preceding, but elongated.

Length, 1.5 mm.; breadth, 0.6 mm.

Locality.—Rancocas formation, Vincentown, New Jersey.
Geological distribution.—Similar to that of preceding form.

POLYMORPHINA OBLONGA d'Orbigny.

Polymorphina oblonga d'Orbigny, 1846; Foram. Foss. Bassin tert. Vienne, p. 232, Pl. XII, figs. 29–31.

Test elongate, consisting of a small number of oblong inflated chambers separated by deep sutures. This feature separates it from *Polymorphina lactea* var. *oblonga* Williamson, which has an oval compressed shell with erect segments and flush sutures.

Length, 1.43 mm.

Locality.—Monmouth formation, Freehold, New Jersey; Rancocas formation, Timber Creek, New Jersey.

Geological distribution.—Cretaceous to Recent.

POLYMORPHINA ORBIGNII (Zborzewski).

Apiopterina d'orbignii Zborzewski, 1834; Nouv. Mém. Soc. Imp. Nat. Moscou, Vol. III, p. 311, Pl. XXVIII, fig. 2 b.

Polymorphina orbignii Parker, Jones, and Brady, 1870; Trans. Linn. Soc. London, Vol. XXVII, p. 244, Pl. XLII, fig. 38 a–c.

Test oval, with a fistulose base; surface of shell smooth. The tube-like projections are very interesting and peculiar, and are the distinguishing feature of the species. They surround the base like a crown, extend out irregularly, and branch at their distal ends. The figures of this species indicate septal divisions, but these are not discernible externally.

Diameter, 0.87 mm.

Locality.—Rancocas formation, Vincentown, New Jersey.

Geological distribution.—Cretaceous and Tertiary.

POLYMORPHINA PROBLEMA (d'Orbigny).

Guttulina problema d'Orbigny, 1826; Ann. Sci. Nat., Vol. VII, p. 266, No. 14, Modèle No. 61.

Polymorphina problema Brady, Parker, and Jones, 1870; Trans. Linn. Soc. London, Vol. XXVII, p. 225, Pl. XXXIX, fig. 11, a-b.

Test oblong ovate, composed of several inflated chambers (six in one specimen) marked by strong septal depressions. Very similar to the more abundant *polymorphina communis*, but differing from that species in the greater number of chambers. Surface of shell smooth; aperture small, rotund, radiate.

Length, 1 mm.; breadth, 0.73 mm.

Locality.—Rancocas formation, New Egypt, Mullica Hill, Timber Creek, New Jersey. Common.

Geological distribution.—Lias to Recent.

POLYMORPHINA REGULARIS von Münster.

Polymorphina regularis von Münster, 1838 (fide Roemer); Neues Jahrb. für Min., p. 385, Pl. III, fig. 21.

Polymorphina regularis Brady, Parker, and Jones, 1870; Trans. Linn. Soc. London, Vol. XXVII, p. 229, Pl. XL, fig. 13 a-c.

Test oblong, compressed, biconvex, narrow below but somewhat broader above; peripheral margin thin, rounded; chambers four to nine, oblique; septal lines marked by slight constrictions visible externally; surface smooth; aperture small, round, central, surrounded by fine grooves.

Length, 1–4 mm.; greatest breadth, 1.6 mm.

Locality.—Rancocas formation, Brownsville, New Jersey.

Geological distribution.—Cretaceous and Tertiary.

Family GLOBIGERINIDÆ.

Genus GLOBIGERINA d'Orbigny.

GLOBIGERINA BULLOIDES d'Orbigny.

Globigerina bulloides d'Orbigny, 1826; Ann. Sci. Nat., Vol. VII, p. 277, No. 1, Modèle No. 17 (young) and No. 76.

Globigerina bulloides Brady, 1884; Chal. Rept., Vol. IX, p. 593, Pl. LXXVII, and Pl. LXXIX, figs. 3–7.

"Test spiral, subtrochoid; superior surface convex, inferior more or less convex, but with deeply sunken umbilicus, periphery rounded, lobulated; adult specimens composed of about seven globose segments, of which four form the outer convolution, the apertures of the individual chambers opening independently into the umbilical vestibule. Diameter, sometimes one-fortieth of an inch (0.63 mm.), but oftener much less." (Brady, loc. cit.)

Locality.—Rancocas formation, Vincentown, Swedesboro, New Jersey; Manasquan formation, Vincentown, New Jersey.

Geological distribution.—Cretaceous to Recent.

This species is not uncommon in the lime sand at Vincentown, but it is rather rare in the overlying Manasquan marl beds. It is, however, much larger in the latter, and some specimens measure 0.4 mm. in diameter.

GLOBIGERINA BULLOIDES var. TRILOBA Reuss.

Globigerina triloba Reuss, 1849; Denks. Akad. Wiss. Wien, Vol. I, p. 374, Pl. XLVII, fig. 11, a-e.

Globigerina bulloides var. *triloba* Brady, 1884; Chal. Rept., Vol. IX, p. 595, Pl. LXXIX, figs. 1, 2; Pl. LXXXI, figs. 2, 3.

Test similar to *Globigerina bulloides*, but distinguished from the latter by its consisting of only three visible chambers in the final convolution. The diameter of the shell varies from 0.5 to 1 mm.

Locality.—Rancocas and Manasquan formations, Vincentown, New Jersey.

Geological distribution.—Cretaceous to Recent.

GLOBIGERINA CRETACEA d'Orbigny.

Globigerina cretacea d'Orbigny, 1840; Mém. Soc. géol. France, ser. 1, Vol. IV, p. 34, Pl. III, figs. 12–14.

Test rotaliform, but strongly depressed; superior surface flattened or but slightly convex, inferior side depressed toward the center and excavated at the umbilicus; periphery obtuse and lobulated; shell typically composed of three fairly distinct convolutions, the outermost consisting of from five to seven segments, the latter relatively small, subglobular; aperture opening into the umbilical vestibule.

Diameter, less than 1^{mm}.

Locality.—Monmouth formation, Freehold, New Jersey; Rancocas formation, Quinton, Vincentown, Mullica Hill, Timber Creek, etc., New Jersey.

Geological distribution.—Cretaceous to Recent (?).

Family ROTALIDÆ.

Subfamily ROTALINÆ.

Genus DISCORBINA Parker and Jones.

DISCORBINA BERTHELOTI (d'Orbigny).

Rosalina bertheloti d'Orbigny, 1839; Foram. Canar., Vol. II, pt. 2, p. 135, Pl. 1, figs. 28–30.

Discorbina bertheloti, Brady, 1884; Chal. Rept., Vol. IX, p. 650, Pl. LXXXIX, figs. 10–12.

Test very strongly compressed, carinate, perforate; spiral side approximately flat, reverse side low, convex; chambers depressed, numerous, convex, with limbate margins.

Similar to *Truncatulina lobatula*, but more depressed, and with more finely perforate walls.

Length, 1.22 mm.; breadth, 0.82 mm.

Locality.—Rancocas formation, Blue Ball, Timber Creek, New Jersey.

Geological distribution.—Cretaceous to Recent.

Genus TRUNCATULINA d'Orbigny.

TRUNCATULINA AKNERIANA (d'Orbigny).

Rotalina akneriana d'Orbigny, 1846; Foram. Foss. Bassin tert. Vienne, p. 156, Pl. VIII, figs. 13–15.

Truncatulina akneriana Reuss, 1866; Denks. Akad. Wiss. Wien, Vol. XXV, p. 160, No. 6.

Truncatulina akneriana Brady, 1884; Chal. Rept., Vol. IX, p. 663, Pl. XCIV, fig. 8, a, b, c.

"The superior face of the test of *Truncatulina akneriana* is flat, the inferior convex at the margin, but depressed toward the umbilicus;

and the convolutions are not completely involute on the inferior side, as in *Truncatulina lobatula*, but leave a portion of the earlier whorls visible at the center." (Brady, loc. cit.)

Diameter, 0.43 mm.

Locality.—Manasquan formation, Vincentown, New Jersey.

Geological distribution.—Cretaceous to Recent.

This form is commonly associated with *Truncatulina lobatula* or *Truncatulina ungeriana*, or with both, and has a similar distribution.

TRUNCATULINA HAIDINGERII (d'Orbigny).

Rotalina haidingerii d'Orbigny, 1846; Foram. Foss. Bassin tert. Vienne, p. 154, Pl. VII, figs. 7, 9.

Truncatulina haidingerii Brady, 1884; Chal. Rept., Vol. IX, p. 663, Pl. XCV, fig. 7, a–c.

Test circular, biconvex, trochoid; volutions three, chambers marked by slightly depressed septa on inferior side, about twelve segments in the last convolution; aperture a small marginal slit.

Diameter, 0.58 mm.

Locality.—Rancocas formation, Vincentown, New Jersey.

Geological distribution.—Cretaceous to Recent.

The above species is similar to *Truncatulina ungeriana*, but differs from it in being more vaulted and less depressed at the umbilicus. It is also a smaller form and is not so abundant, being rather rare in the middle marl bed. There is, furthermore, no distinct groove following the whorls upon the superior side, and the perforations are smaller than in *Truncatulina ungeriana*.

TRUNCATULINA LOBATULA (Walker and Jacob).

Nautilus lobatulus Walker and Jacob, 1798; Adams's Essays, Kanmacher's ed., p. 642, Pl. XIV, fig. 36.

Truncatulina lobatula Brady, 1884; Chal. Rept., Vol. IX, p. 660, Pl. XCII, fig. 10; Pl. XCIII, figs. 1, 4, 5; Pl. CXV, figs. 4, 5.

Test plano-convex, moderately vaulted; last volution consisting of seven or eight chambers, with very slightly depressed septa; septa more curved upon the superior (flat) surface; aperture a small, neatly shaped arch at the margin of the ultimate segment.

Diameter, 0.36–1.13 mm.

Locality.—Matawan formation, Marshalltown, New Jersey; Monmouth formation, Freehold, New Jersey; Rancocas formation, Vincentown, New Egypt, Mullica Hill, etc., New Jersey; Manasquan formation, Vincentown, New Jersey.

Geological distribution.—Carboniferous to Recent.

The above species shows great variation. Professor Brady considers that the more convex varieties merge into *Truncatulina refulgens*, while flattened forms resemble *Truncatulina wuellerstorfi*. The regular-built convex varieties constitute the *Truncatulina boueana* of d'Orbigny, and the less regular the *Truncatulina variabilis* of the same author.

TRUNCATULINA REFULGENS (Montfort).

Cibicides refulgens, Montfort, 1808; Conch. Syst., Vol. I, p. 122, 31° genre.
Truncatulina refulgens, Brady, 1884; Chal. Rept., Vol. IX, p. 659, Pl. XCII, figs. 7–9.

Test subconical, superior surface complanate, inferior very much elevated; consisting of about eight chambers in the last convolution; sutures somewhat depressed upon the inferior (vaulted) surface; peripheral margin sharp; aperture an inframarginal opening near the base of the ultimate segment.

Diameter, 0.5 mm.

Locality.—Manasquan formation (?), Vincentown, New Jersey.

Geological distribution.—Cretaceous (Upper?) to Recent.

There is a possibility that this is an Eocene fossil, as it was obtained from some of the uppermost greensand of the New Jersey Cretaceous, which carries a number of Eocene fossils, together with some of late Cretaceous age. The specimens came from the upper marl bed at Vincentown, and only a very few forms were found.

TRUNCATULINA UNGERIANA (d'Orbigny).

Rotalina ungeriana, d'Orbigny, 1846; Foram. Foss. Bassin tert. Vienne, p. 157, Pl. VIII, figs. 16–18.
Truncatulina ungeriana, Brady, 1884; Chal. Rept., Vol. IX, p. 664, Pl. XCIV, fig. 9, a–d.

Test large, rotaliform, circular, coarsely porous, both sides moderately convex, unequal, depressed slightly on the inferior side at the umbilicus, consisting of three convolutions. The last volution consists of from ten to twelve limbate chambers. Septa arched; aperture a median semilunar slit.

Diameter, 0.78 mm.

Locality.—Rancocas formation, New Egypt, New Jersey; Manasquan formation, Vincentown, New Jersey.

Geological distribution.—Cretaceous to Recent.

This species is rather common at New Egypt. In the upper marl bed the forms are much smaller, the shell being only about one-half the size of the New Egypt specimens.

TRUNCATULINA WUELLERSTORFI (Schwager).

Anomalina wüllerstorfi Schwager, 1866; Nov. Exped. geol. Theil., Vol. II, p. 258, Pl. VII, figs. 105, 107.

Test circular, coarsely porous; inferior surface convex, superior complanate; peripheral edge acute; chambers narrow; septa strongly curved, crescent-shaped with broad septal ridges, nine in the last convolution; aperture a small marginal cleft.

Diameter, 0.5 mm.

Locality.—Manasquan formation, Vincentown, New Jersey.

Geological distribution.—Upper Cretaceous to Recent.

This species is similar in its outline to figure 8, Plate XCIII, Challenger Report, Vol. IX. None of our specimens are as flat as figure 9 of the same plate, which Professor Brady considers the more typical

form. This author states that this species is described from the Pliocene deposits of Kar Nicobar by Schwager, but does not mention its earlier occurrence. It is an intermediate form between *Truncatulina lobatula* and *Anomalina ariminensis*.

Genus ANOMALINA, d'Orbigny.

ANOMALINA AMMONOIDES (Reuss).

Plate VI, fig. 5.

Rosalina ammonoides, Reuss, 1845–46; Verstein. böhm Kreide, pt. 1, p. 36, Pl. VIII, fig. 53; Pl. XIII, fig. 66.
Anomalina ammonoides, Brady, 1884; Chal. Rept., Vol. IX, p. 672, Pl. XCIV, figs, 2, 3.

Test nautiloid, coarsely porous, small, compressed; lateral surfaces nearly equally convex; depressed at the umbilici; peripheral edge round; aperture an arched, nearly medium slit upon the inner margin of the ultimate segment.

Diameter, 0.5–0.8 mm.

Locality.—Monmouth formation, Freehold, Bruere's pits on Crosswicks Creek, New Jersey; Rancocas formation, Vincentown, New Egypt, Timber Creek, etc., New Jersey.

Geological distribution.—Cretaceous to Recent.

ANOMALINA GROSSERUGOSA (Gümbel).

Plate VI, fig. 4.

Truncatulina grosserugosa, Gümbel, 1868; Abhandl. d. k. bayer. Akad. Wiss., Vol. X, p. 660, Pl. II, fig. 104, a. b.
Anomalina grosserugosa, Brady; Chal. Rept., Vol. IX, p. 673, Pl. XCIV, figs. 4, 5.
Anomalina grosserugosa, Sherborn and Chapman, 1889; Journ. Royal Microsc. Soc., p. 487, Pl. XI, fig. 34.

Test nautiloid, very coarsely porous, pores larger and more numerous upon inferior surface; both sides convex; umbilici distinct; peripheral margin round; chambers large, inflated, only eight in final convolution; septa nearly straight; aperture median, arched.

Diameter, 0.43–0.82 mm.

Locality.—Rancocas formation, Swedesboro, New Jersey; Manasquan formation, Vincentown, New Jersey.

The above species is very similar to *Anomalina ammonoides*, but differs from it in being relatively larger and thicker, with a smaller number of chambers in the final convolution, and also in its more obtusely rounded margin.

Genus PULVINULINA Parker and Jones.

PULVINULINA KARSTENI (Reuss).

Rotalia karsteni Reuss, 1855; Zeit. geol. Gesell., Vol. VII, p. 273, Pl. IX, fig. 6.
Rotalia karsteni Reuss, 1861; Sitz. Akad. Wiss. Wien., Vol. XLIV, pt. 1, p. 337.
Pulvinulina karsteni Brady, 1884; Chal. Rept., Vol. IX, p. 698, Pl. CV, figs. 8, 9.

Test circular, regularly built, convex on both sides, with obtuse-

angular periphery; composed of from three to four convolutions; septal markings on superior surface apparent as fine lines, while the lower surface shows slight depressions of the radiating septa; last convolution consisting of six or seven chambers; aperture a cleft on the lower side somewhat removed from the margin.

Length, 0.45–0.5 mm.

Locality.—Rancocas formation, Vincentown, Quinton, New Jersey.

Geological distribution.—Cretaceous to Recent.

PULVINULINA MICHELINIANA (d'Orbigny).

Rotalina truncatulinoides d'Orbigny, 1839; Foram. Canaries, Vol. II, pt. 2, p. 132, Pl. II, figs. 25–27.

Rotalina micheliniana d'Orbigny, 1840; Mém. Soc. géol. France, ser. 1, Vol. IV, p. 31, Pl. III, figs. 1–3.

Test orbicular, superior surface nearly flat, inferior highly convex, with an excavated umbilicus; spire complanate, with three convolutions; last volution consisting of ten or twelve chambers, angular, separated by straight septal lines below; aperture elongate, slightly removed from the margin.

Diameter, 0.45 mm.

Locality.—Rancocas formation, Blue Ball, Timber Creek, New Jersey.

Geological distribution.—Cretaceous to Recent.

This is not a common species, but was described by Prof. A. E. Reuss under the name *Rotalina nitida*, which he considered to be a young form of *Rotalina umbilicata* d'Orbigny. Dr. W. B. Carpenter considers that the *Rotalina umbilicata* of the Chalk is identical with *Rotalina soldanii* of the Vienna Tertiaries. Prof. H. B. Brady states that *Pulvinulina micheliniana* has its isomorph in *Truncatulina refulgens*, from which species it is distinguished by the more or less excavated umbilicus and the projecting apical margins of the segments. In the Challenger Report, however, *Rotalina nitida* is not given under the synonyms of *Pulvinulina micheliniana*, but Dr. Woodward has so considered it in his report on the Cretaceous Foraminifera of New Jersey, and it seems probable that this view is correct.

PULVINULINA RETICULATA Reuss, var. CARINATA Bagg.

Plate V, figs. 3a, 3b.

Test discoidal, both sides moderately convex, peripheral margin possessing a large double heel; surface of shell smooth and shining, marked upon the superior surface by broad, curving septal lines; convolutions about three; eight chambers in the last volution; inferior surface less distinct, umbilicus marked by radiating lines nearly straight, but not distinct beyond one-third their length; no aperture visible.

Diameter, 0.87 mm.

Locality.—Monmouth formation, Freehold, New Jersey.

Geological distribution.—Cretaceous.

OLOGICAL DISTRIBUTION OF THE FORAMINIFERA DESCRIBED IN THIS REPORT.

Species.	Formation.			
	Mata-wan.	Nave-sink.	Ranco-cas.	Mana-squan.
LITUOLIDÆ.				
hragmium concavum Bagg			×	
hragmium irregulare Roemer			×	
mmina inflata (Montagu)			×	
TEXTULARIDÆ.				
aria agglutinans d'Orbigny			×	×
aria agglutinans var. porrecta Brady			×	
aria gibbosa d'Orbigny		×		
aria globulosa Ehrenberg		×		
aria gramen d'Orbigny			×	
aria sagittula Defrance			×	
aria turris d'Orbigny			×	
ilina polystropha (Reuss)		×		
ilina triquetra (von Münster)			×	×
ia tortilis (Reuss)			×	
ia tricarinata (Reuss)			×	×
rina pupoides d'Orbigny			×	
ina communis d'Orbigny			×	
ina parisiensis d'Orbigny			×	
na puschi Reuss		×		
na variabilis d'Orbigny		×		
a punctata d'Orbigny	×	×		
a textilaroides Reuss	×			
stomella subnodosa Reuss			×	
LAGENIDÆ.				
globosa (Montagu)			×	
ebbina lævis (Sollas)			×	
ebbina sollasi Chapman			×	
ria acuminata Reuss			×	
ria adolphinula (d'Orbigny)			×	
ria annulata Reuss		×	×	
ria communis (d'Orbigny)		×	×	
ria consobrina (d'Orbigny)	×			
ria consobrina var. emaciata Reuss	×		×	
ria farcimen (Soldani)			×	
ria filiformis d'Orbigny		×	×	
ria indifferens (Reuss)		×		
ria inornata (d'Orbigny)	×			
ria lævigata (d'Orbigny)			×	
ria longiscata d'Orbigny				×
ria multicostata d'Orbigny			×	
ria nitida d'Orbigny			×	
ria obliqua (Linné)	×	×	×	×
ria pauperata d'Orbigny				×
ria polygona Reuss	×	×	×	×
ria radicula (Linné)			×	
ria raphanus (Linné)			×	
ria rœmeri (Neugeboren)	×			
ria rotundata (Reuss)			×	
ria scabra (Reuss)				×
ria spinulosa (Montagu)				×

Geological distribution, etc.—Continued.

Species.	Formation.			
	Matawan.	Navesink.	Rancocas.	Manasquan.
LAGENIDÆ—continued.				
Nodosaria vertebralis (Batsch)			×	
Nodosaria williamsi Bagg			×	
Nodosaria zippei Reuss	×	×	×	×
Lingulina carinata d'Orbigny			×	
Frondicularia alata d'Orbigny			×	
Frondicularia angusta Nilsson, var. dimidia Bagg			×	
Frondicularia archiaciana d'Orbigny var. strigillata Bagg			×	
Frondicularia clarki Bagg		×		
Frondicularia gaultina Reuss	×			
Frondicularia inversa Reuss		×		
Frondicularia lanceola Reuss		×		
Frondicularia major Bornemann			×	
Frondicularia ovata Roemer	×		×	
Frondicularia pulchella Karrer	×			
Frondicularia reticulata Reuss		×		
Frondicularia verneuilina d'Orbigny	×			
Rhabdogonium roemeri Reuss	×			
Rhabdogonium tricarinatum d'Orbigny			×	
Rhabdogonium tricarinatum var. acutangulum Reuss	×			
Marginulina ensis Reuss		×	×	
Marginulina pediformis Bornemann	×			
Marginulina trilobata d'Orbigny	×	×		
Vaginulina legumen (Linné)	×		×	
Vaginulina strigillata Reuss		×		
Cristellaria acutauricularis (Fichtel & Moll)			×	
Cristellaria articulata (Reuss)			×	
Cristellaria cassis (Fichtel & Moll)			×	
Cristellaria crepidula (Fichtel & Moll)			×	
Cristellaria cretacea Bagg			×	
Cristellaria cultrata (Montfort)		×	×	
Cristellaria gibba d'Orbigny	×		×	
Cristellaria italica Defrance			×	
Cristellaria mamilligera Karrer			×	
Cristellaria megapolitana (Reuss)		×		
Cristellaria projecta Bagg			×	
Cristellaria rotulata (Lamarck)			×	×
Cristellaria secans Reuss		×		
Cristellaria trachyomphala Reuss			×	
Cristellaria triangularis d'Orbigny		×		
Cristellaria wetherellii (Jones)			×	
Flabellina cordata Reuss			×	
Flabellina sagittaria (Lea)			×	
Polymorphina compressa d'Orbigny			×	
Polymorphina communis (d'Orbigny)			×	
Polymorphina emersoni n. sp		×		
Polymorphina gibba (d'Orbigny)		×	×	
Polymorphina lactea (Walker & Jacob)		×	×	
Polymorphina lactea var. elongate Brady			×	
Polpmorphina oblonga d'Orbigny		×	×	
Polymorphina orbignii (Zborzewski)			×	
Polymorphina problema (d'Orbigny)			×	
Polymorphina regularis von Münster			×	

Geological distribution, etc.—Continued.

Species.	Formation.			
	Matawan.	Navesink.	Rancocas.	Manasquan.
GLOBIGERINIDÆ.				
Globigerina bulloides d'Orbigny	.....	.....	×	×
Globigerina bulloides var. triloba Reuss	.....	.....	×	×
Globigerina cretacea d'Orbigny	.....	×	×	.....
ROTALIDÆ.				
Discorbina bertheloti (d'Orbigny)	.....	.....	×	.....
Truncatulina akneriana (d'Orbigny)	.....	.....	.....	×
Truncatulina haidingerii (d'Orbigny)	.....	.....	×	.....
Truncatulina lobatula (Walker & Jacob)	×	×	×	×
Truncatulina refulgens (Montfort)	.....	.....	.....	×
Truncatulina ungeriana (d'Orbigny)	.....	.....	×	×
Truncatulina wuellerstorfi (Schwager)	.....	.....	.....	×
Anomalina ammonoides (Reuss)	.....	×	×	.....
Anomalina grosserugosa (Gümbel)	.....	.....	×	×
Pulvinulina karsteni (Reuss)	.....	.....	×	.....
Pulvinulina micheliniana (d'Orbigny)	.....	.....	×	.....
Pulvinulina reticulata Reuss, var. carinata Bagg	.....	×	.....	.....
Total	20	32	79	19

PLATES.

PLATE I.

PLATE I.

DIAGRAMS ILLUSTRATING DESCRIPTIVE TERMS.

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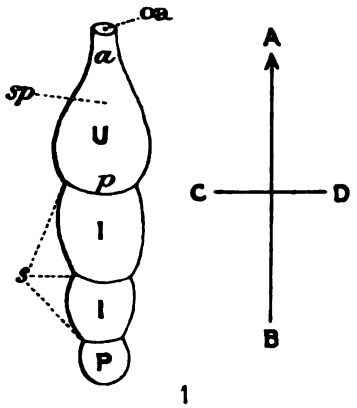

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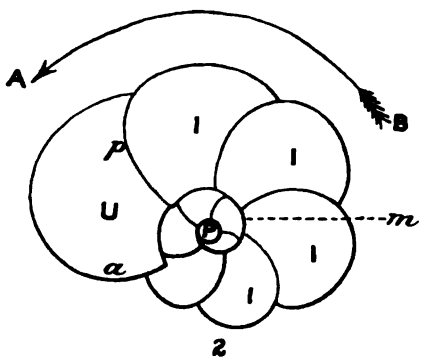

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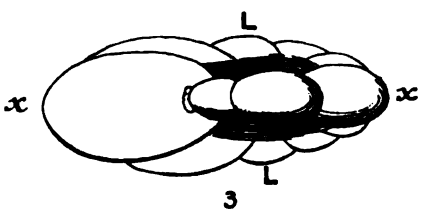

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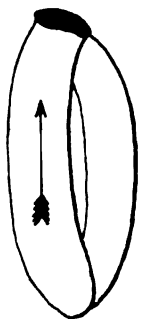

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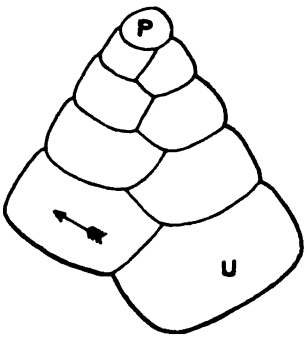

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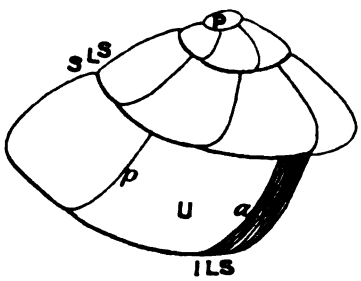

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DIAGRAMS ILLUSTRATING DESCRIPTIVE TERMS

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PLATE II.

CRETACEOUS FORAMINIFERA.

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1a

1b

2

4a

4b

3

5a

5b

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CRETACEOUS FORAMINIFERA

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PLATE III.

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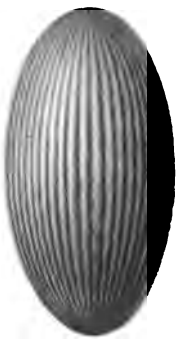
1



2a

2b

4

5

3

6

7a

7b

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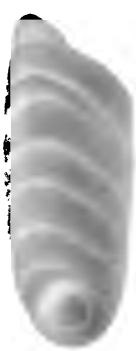
1a

1b

3

2b

2a



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5a

5b

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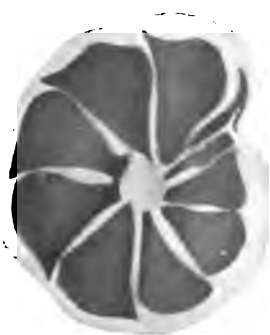
1a

1b

2a

2b



3a

3b

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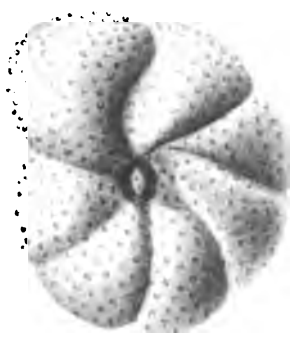

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WATER-SUPPLY AND IRRIGATION PAPERS.

By act of Congress approved June 11, 1896, the following provision was made:

"*Provided*, That hereafter the reports of the Geological Survey in relation to the gauging of streams and to the methods of utilizing the water resources may be printed in octavo form, not to exceed one hundred pages in length and five thousand copies in number; one thousand copies of which shall be for the official use of the Geological Survey, one thousand five hundred copies shall be delivered to the Senate, and two thousand five hundred copies shall be delivered to the House of Representatives, for distribution.'

Under this law the following papers have been published:

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When, in 1882, the Geological Survey was directed by law to make a geologic map of the United States, there was in existence no suitable topographic map to serve as a base for the geologic map. The preparation of such a topographic map was therefore immediately begun. About one-fifth of the area of the country, excluding Alaska, has now been thus mapped. The map is published in atlas sheets, each sheet representing a small quadrangular district, as explained under the following heading. The separate sheets are sold at 5 cents each when fewer than 100 copies are purchased, but when they are ordered in lots of 100 or more copies, whether of the same sheet or of different sheets, the price is 2 cents each. The mapped areas are widely scattered, nearly every State being represented. More than 800 sheets have been engraved and printed; they are tabulated by States in the Survey's "List of Publications," a pamphlet which may be had on application.

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The Geologic Atlas of the United States is the final form of publication of the topographic and geologic maps. The atlas is issued in parts, progressively as the surveys are extended, and is designed ultimately to cover the entire country.

Under the plan adopted the entire area of the country is divided into small quadrangular districts (designated *quadrangles*), bounded by certain meridians and parallels. The unit of survey is also the unit of publication, and the maps and descriptions of each quadrangular district are issued as a folio of the Geologic Atlas.

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Two forms of issue have been adopted, a "library edition" and a "field edition." In both the sheets are bound between heavy paper covers, but the library copies are permanently bound, while the sheets and covers of the field copies are only temporarily wired together.

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STATISTICAL PAPERS.

Mineral Resources of the United States, 1882, by Albert Williams, jr. 1883. 8°. xvii, 813 pp. Price 50 cents.

Mineral Resources of the United States, 1883 and 1884, by Albert Williams, jr. 1885. 8°. xiv, 1016 pp. Price 60 cents.

Mineral Resources of the United States, 1885. Division of Mining Statistics and Technology. 1886. 8°. vii, 576 pp. Price 40 cents.

Mineral Resources of the United States, 1886, by David T. Day. 1887. 8°. viii, 813 pp. Price 50 cents.

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Mineral Resources of the United States, 1893, by David T. Day. 1894. 8°. viii, 810 pp. Price 50 cents.

On March 2, 1895, the following provision was included in an act of Congress:

"*Provided*, That hereafter the report of the mineral resources of the United States shall be issued as a part of the report of the Director of the Geological Survey."

In compliance with this legislation the following reports have been published:

Mineral Resources of the United States, 1894, David T. Day, Chief of Division. 1895. 8°. xv, 646 pp., 23 pl.; xix, 735 pp., 6 pl. Being Parts III and IV of the Sixteenth Annual Report.

Mineral Resources of the United States, 1895, David T. Day, Chief of Division. 1896. 8°. xxiii, 542 pp., 8 pl. and maps; iii, 543–1058 pp., 9–13 pl. Being Part III (in 2 vols.) of the Seventeenth Annual Report.

Mineral Resources of the United States, 1896, David T. Day, Chief of Division. 1897. 8°. xii, 642 pp., 1 pl.; 643–1400 pp. Being Part V (in 2 vols.) of the Eighteenth Annual Report.

The report on the mineral resources for the calendar year 1897 will form a part of the Nineteenth Annual Report of the Survey.

The money received from the sale of the Survey publications is deposited in the Treasury, and the Secretary of the Treasury declines to receive bank checks, drafts, or postage stamps; all remittances, therefore, must be by MONEY ORDER, made payable to the Director of the United States Geological Survey, or in CURRENCY—the exact amount. Correspondence relating to the publications of the Survey should be addressed to—

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UNITED STATES GEOLOGICAL SURVEY

CHARLES D. WALCOTT, DIRECTOR

SOME LAVA FLOWS

OF THE

WESTERN SLOPE OF THE SIERRA NEVADA, CALIFORNIA

BY

F. LESLIE RANSOME

WASHINGTON

GOVERNMENT PRINTING OFFICE

1898

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LETTER OF TRANSMITTAL.

DEPARTMENT OF THE INTERIOR,
UNITED STATES GEOLOGICAL SURVEY,
Washington, D. C., June 19, 1897.

SIR: I have the honor to transmit herewith an illustrated paper by Dr. F. L. Ransome on some lavas from California that are regarded as intermediate between trachytes and andesites. It may be noted that these rocks occupy the same position among the effusives that certain of the rocks called monzonite by Brögger do among the granolites.

It is recommended that the paper be published as a bulletin.

Very respectfully, yours,

H. W. TURNER,
Geologist.

Hon. CHARLES D. WALCOTT,
Director United States Geological Survey.

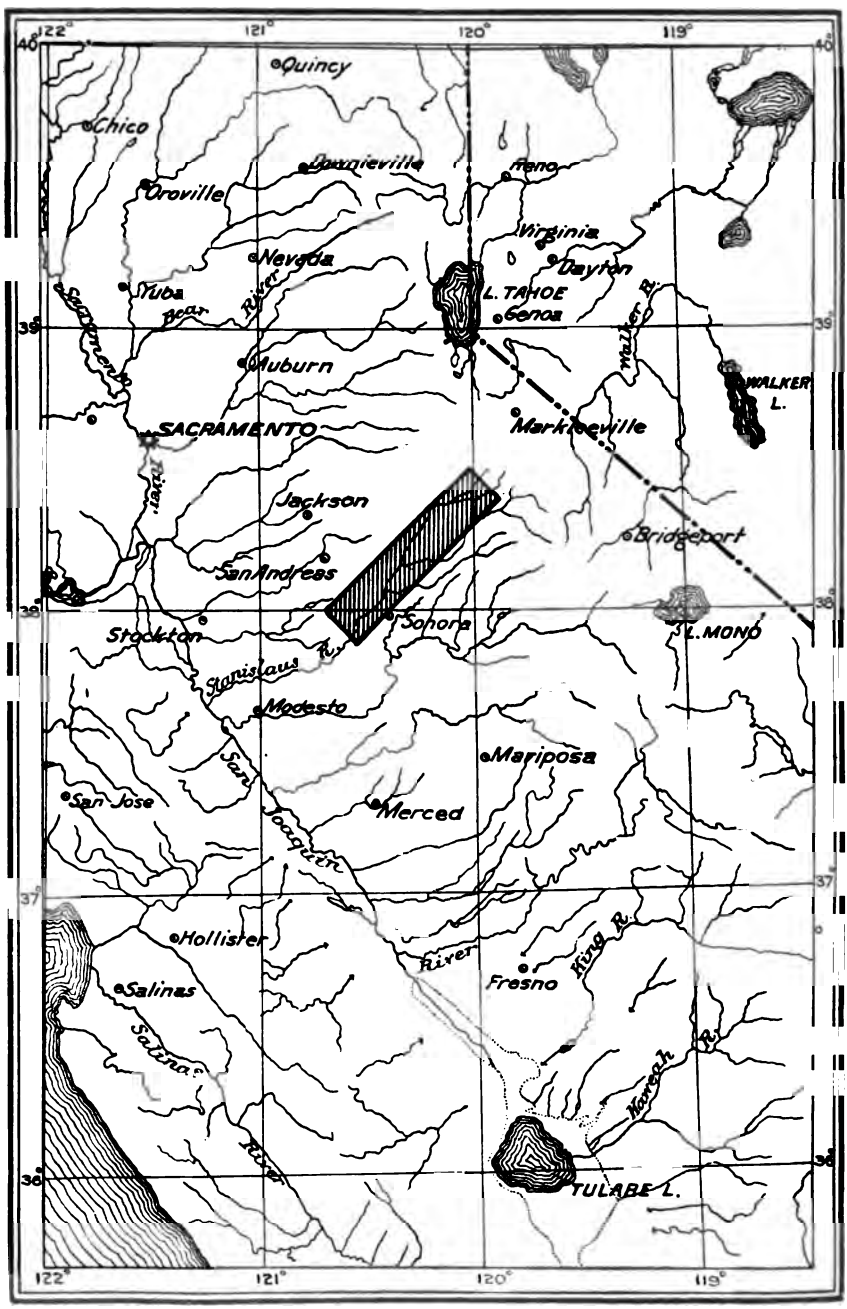


DIAGRAM SHOWING THE POSITION OF THE AREA EMBRACED BY THE MAP (PL. II).

SOME LAVA FLOWS OF THE WESTERN SLOPE OF THE SIERRA NEVADA, CALIFORNIA.

By F. Leslie Ransome.

INTRODUCTION.

The field relationships of the rocks described in the following paper were studied during the summers of 1895 and 1896, while I was engaged in geologically mapping portions of the Sonora and Big Trees quadrangles, under the direction of Mr. H. W. Turner. It was seen that this particular set of lavas offered a promising field for more detailed work than could be given to the region as a whole, and Mr. Turner kindly suggested that I should undertake their investigation as a special problem, to be carried along in conjunction with the regular areal work of the quadrangles. It was found that, in addition to the andesitic tuffs and breccias (designated upon the completed folios of the Gold Belt of California "Neocene andesite-tuff," or "Neocene andesite"), which are so widely and monotonously developed over the broad western slope of the Sierra Nevada, there occurs within the district studied another series of lavas in the form of massive flows, of much more limited distribution. They are in some cases closely associated with the breccias and tuffs, but are always readily recognized by their prevailingly massive character and by certain very distinctive lithological features. Taken as a whole, they form a series of superimposed flows, extending in a southwest direction from some as yet unknown source near the crest of the range in Alpine County down to the little village of Knights Ferry, in Stanislaus County, on the border of the Great Valley—a distance of more than 60 miles as the crow flies. Only one of the flows is known to have extended the whole distance, and they have all suffered considerable dissection through the very incisive gashing of the present streams, but in a general way the line of flow may be said to follow the course of the Stanislaus River. These flows were poured out within the period of eruptive activity, during which the andesitic breccias and tuffs were spread for hundreds of square miles over the western slope of the Sierra; but their eruption was immediately preceded by an interval of sharp erosion, which cut out the channels down which they flowed

toward the valley. Subsequently they were again partly covered by fresh andesitic breccia, especially in the higher portions of the range.

The distinctive chemical feature of these rocks is a rather high percentage of total alkalies, with the potash somewhat in excess of the soda. Chemically they stand between typical andesites and typical trachytes, and belong to a general chemical group of the effusive rocks which it seems necessary to classify under a new name. Without anticipation of a discussion which has its proper place after the rocks themselves have been described, the name *latite* (derived from the Italian province of Latium or Latia, where rocks closely related to those described in the present paper occur abundantly), may be considered for the present as used merely to indicate the group of lavas which form the subject of the present paper, for the purpose of avoiding confusion with the ordinary clastic andesites abundant in the same field.

The laboratory work embodied in the preparation of this paper was carried on in the petrographical laboratory of Harvard University, and my thanks are due to Professor Wolff for the excellent facilities there enjoyed. I am also indebted to Mr. Turner not only for the original permission to undertake the work, but for generously aiding it in many ways and for furnishing field notes of such occurrences of the latites as fell within his own portions of the general area.

GENERAL OUTLINE OF THE PHYSIOGRAPHY OF THE REGION.

The accompanying map (Pl. II) embraces a rectangular strip of country 63 miles in length and 14.5 miles in width, with its longer dimension lying very nearly northeast and southwest. It includes portions of the Oakdale, Sonora, Jackson, Big Trees, Dardanelles, and Pyramid Peak atlas sheets, and the general position of the district covered is indicated in the annexed diagram (Pl. I). Considerably more than half the area lies within the Big Trees sheet. The extreme southwestern portion, lying west of longitude 120° 30′ and south of latitude 38°, is from the northeast corner of the unfinished Oakdale sheet. The topography is here only partly indicated, and the areas of latite are drawn with approximate outlines subject to revision when the region is examined in detail with a finished topographical map. A similar explanation should also be made with regard to the corner of the map lying east of longitude 120°, which is a part of the Dardanelles sheet. The work in this area was limited to a rapid reconnaissance, before the completion of the topographical base, and the areas of Neocene lavas will require slight modifications and considerable additions when the areal geology of the Dardanelles quadrangle is worked out in full.

The elevations on the map range from a general altitude of about 500 feet, near Knights Ferry, to 9,529 feet, on the summit of Dardanelle Cone, in Alpine County, corresponding to an average grade of 150 feet per mile for this portion of the Sierra slope. As a whole, this area is

practically destitute of alluvial valley bottoms, and is drained by streams of torrential character. It is traversed from end to end by the comparatively young consequent Stanislaus River, with its two principal branches, the North and the Middle forks, and may be regarded as a thoroughly typical transverse strip of the great tilted and dissected peneplain which forms the western slope of the Sierra Nevada. The rocks upon which this somewhat uneven peneplain has been carved are those of the so-called "Bed-rock series" of the Gold Belt folios, and are of Juratrias and earlier age. In the foothill region they consist of closely compressed clay slates, schists, limestones, quartzites, and various igneous rocks, while in the higher portions of the slope gneissoidal and granitic rocks prevail.

Toward the end of the base-leveling process, which, as shown by Diller[1] and Lindgren[2] for other portions of the Sierra, lasted at least into the Miocene, the series of volcanic eruptions began which continued through the Pliocene, and which ended by covering the old surface far and wide with a blanket of clastic andesitic material in the form of breccias, rolled gravels, and fine tuffs. At the same time began the differential elevation which has given the peneplain its present slope of about two degrees to the southwest. According to Lindgren,[3] there is still recognizable a peneplain of Cretaceous age in the common altitude of many of the higher peaks of the middle Sierra, but no survival of such an intermediate stage of base-leveling has been detected in this region of the Stanislaus drainage.

The old surface revealed to-day by the stripping off of a great part of its andesitic cover is by no means a perfectly even one. If the sharp V-shaped canyons of post-Tertiary date were all filled up, and the remnants of the Tertiary volcanic cover quite removed, there would still remain a surface of gentle relief surmounted by occasional monadnocks. On the whole, though, it would be a topography of greatly subdued relief when contrasted with the possibilities for alpine types of form suggested by the nearly vertical schistose rocks and batholithic plutonic masses out of which it was carved.

The peneplain character has not been equally well preserved in all portions of the region. In the foothill districts it is recognizable only in a very general way, erosion having largely obliterated the old surface or obscured it by the etching out of later and local lowlands. The reason for this is threefold: The foothill regions are not only composed of belts of highly tilted heterogeneous rocks, originally unfavorable to the production of an ideal peneplain, but in addition to this they were probably never so thoroughly covered by the coarse andesitic breccias as were the higher portions of the slope. Moreover, the lack of homogeneity in the underlying rocks has led to the rapid development in Pleistocene time of small subsequent streams along belts of weaker

[1] Topographical revolution on the Pacific coast: Fourteenth Ann. Rept. U. S. Geol. Survey, Part II, 1894, pp. 419–421.

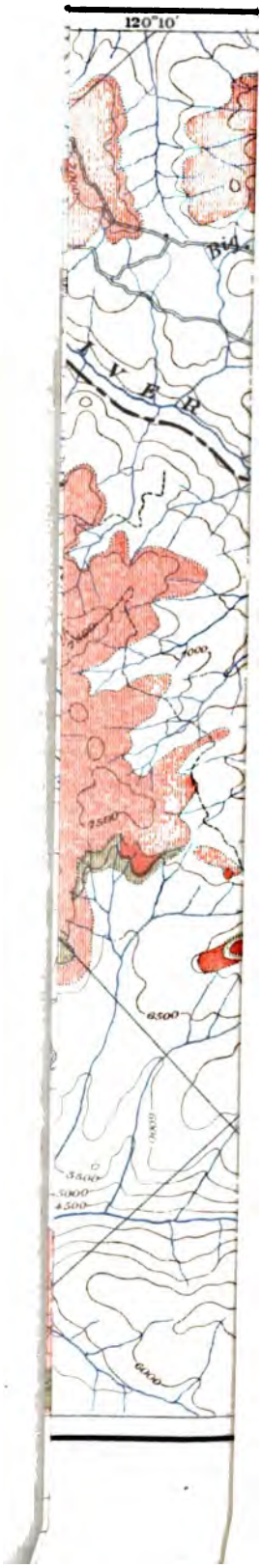
[2] Age of the auriferous gravels of the Sierra Nevada: Jour. Geol., Vol. IV, 1896, pp. 893 and 898.

[3] Loc. cit., p. 897.

tops are generally bare, or covered only with patches of low-g shrubs and scattered trees, they are the natural routes of through the district and are followed by the sheep and cattle h who make use of the higher mountain meadows during the s months. In contrast with the bare or open character of the ridg intervening slopes and canyons are generally heavily foreste noble trees, including the famous "mammoth trees" (*Sequoia gig* the more graceful and scarcely less majestic "sugar pine" (*Pin bertiana*), and the massive "yellow pine" (*Pinus ponderosa*).

Following one of the ridges the traveler may ride for hour scarcely perceptible grade toward the northeast, with a wide pr over the treetops on either hand and a view of similar ridges distance. But if, as Whitney says, speaking of the mining reg the Sierra, "he turn and attempt to make his way across the co in a line parallel with the crest of the range, he will discover th apparent plain is cut into by the gorges or canyons in which the p rivers run in a most extraordinary manner; he will find it several work to descend into one of these and rise again to the genera on the other side, even if he be assisted by a well-beaten trail."[1]

The drainage of the middle portion of the slope differs from t the foothill region in the absence or insignificance of purely subs streams. The larger tributaries show a tendency to flow straigh the tilted peneplain, entering the main trunk streams obliquel frequently after running for a long distance nearly parallel with as in the case of Beaver Creek and the North Fork of the Stan the former being at one point apparently in imminent danger ture by the latter. As a result of this consequent system of dra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streams, having cut through the Neocene cover of andesitic breccia, are still energetically sinking their steep-walled, V-shaped canyons into the underlying granitic rocks. These canyons as yet show little tendency to widen out into valleys, and remnants of the former extensive covering of andesite are often preserved on their very brinks. The vigorous nature of this trenching is well shown in the deep canyon of the Mokelumne River, of which a small portion comes within the map just north of Bear Valley, and also in the whole canyon of the Middle Stanislaus. There are probably few better illustrations of a young V-shaped canyon than can be seen by looking westward from a point about halfway down the trail which is shown descending into the gorge a mile and a half west of Mount Knight.

From Clover Meadow eastward the character of the country changes, although the change is not an abrupt one. The various residual andesitic ridges which have converged just west of Clover Meadow extend eastward as a single main ridge into the area of the Dardanelles quadrangle, between Highland Creek on the north and the Middle Stanislaus River on the south. About 2 miles east of Clover Meadow the ridge ends in a steep bluff about 400 feet in height. The brink of this declivity affords a view (Pl. III) which, aside from its somewhat stern beauty, is of considerable interest. For many miles to the northeast the eye overlooks a wild, hummocky surface of bare and glaciated granite,[1] stretching up toward the crest of the range, its dazzling whiteness being only partly relieved by a sparse growth of pines. In the near foreground the bald hummocks are interspersed with small, bright-green meadows, fringed with quivering aspens, and usually inclosing a lakelet. Immediately to the east, and just across the low, hummocky foreground, the dark and rugged peaks of the Dardanelles rise to an altitude 9,529 feet above the sea. The nearest peak, which may be conveniently called the West Dardanelle, can be plainly seen to be made up of a series of nearly horizontal volcanic layers, resting upon the granite and capped by a heavy flow of dark columnar lava, forming vertical cliffs several hundred feet in height. Beyond the Dardanelles appear the higher peaks forming the crest of the Sierra, also in part capped by volcanic rocks in nearly horizontal attitudes. These embrace some well-stratified andesitic tuffs, as observed by Turner[2] on the summit of Arnot Peak at an elevation of 10,000 feet.

This higher portion of the Sierra slope can not, then, like that west of Clover Meadow, be characterized as a series of more or less linear lava-capped ridges, separated by narrow canyons. The possibility of riding easily along the flat ridge tops has ended with the bluff upon which the observer stands. From here on to the summit the Neocene volcanic covering has been so thoroughly dissected and carried away that only a few scattered remnants testify to its once great extent.

[1] The term granite is used throughout this paper in a general sense, including all the "granodiorite," quartz-mica-diorite, etc., as well as true granite.

[2] Geology of the Sierra Nevada: Seventeenth Ann. Rept. U. S. Geol. Survey, Part I, 1896, p. 708.

The region is best described as a rolling and hummocky granitic slope—a portion of the old peneplain modified by ice action and by recent erosion. Above this old surface stand isolated peaks and clusters of peaks, often true flat-topped buttes, composed of volcanic materials. Distinctly below it are the deep trenches of the larger streams, their character being well shown in the fine gorge of the Middle Stanislaus, 4 miles southeast of Clover Meadow. An idea of the general character of the region may be gained from Pl. X (p. 32), which is a view of the Dardanelles from the south, looking across the canyon of the Stanislaus.

The foregoing account of the physiography of the region embraced in the accompanying map (Pl. II) is little more than a bare outline, intended to present some picture of the old uneven peneplain, with its Neocene cover of fragmental andesite, down which the latitic lavas flowed, and of the general character of the erosion by which it has since been modified. No reference has been made to the influence of ice action upon the drainage, for the reason that there is no patent evidence that the important streams have retained any traces of ice interference. Definite moraines are rare, and although a few morainal patches occur on some of the ridges as low down as 5,500 feet, they are not shown on the present map. Various details of topography which are closely connected with the occurrence and distribution of the latites can be more intelligibly discussed under that head than in a general preliminary sketch, and will be for the present deferred.

THE OCCURRENCE AND DISTRIBUTION OF THE LAVAS (LATITES).

The latites were early differentiated in the field into three varieties, belonging to at least three distinct flows. These are, in the order of their geological sequence: (1) a dark, compact augite-latite of somewhat basaltic aspect, with conspicuous tabular crystals of labradorite and smaller phenocrysts of augite, which for convenience will be referred to as the Table Mountain facies; (2) a moderately dark-gray biotite-augite-latite, in which glistening tablets of biotite are the most conspicuous phenocrysts; (3) a dark, very compact augite-latite, with small, scattered phenocrysts of labradorite and augite, which may be called the Dardanelle facies from its occurrence on the extreme summit of the West Dardanelle.

The Table Mountain facies forms the longest flow of the series, having been traced from the West Dardanelle, where its surface attains an elevation of about 8,600 feet, down to Knights Ferry, where it forms plateaus, with black, bowlder-strewn surfaces, about 500 feet above sea. The rough, bowlder-like masses, from a foot to 2 feet in diameter, locally known as "nigger-heads," which are frequently abundant on the surface of the flow near Knights Ferry, are of the same character as the solid lava beneath them; and as the latites rarely show any

THE DARDANELLES FROM THE WEST, SHOWING THE HUMMOCKY GRANITIC SURFACE IN THE FOREGROUND AND THE CREST OF THE SIERRA NEVADA IN THE DISTANCE.

signs of weathering into soil, these were possibly originally loose fragments borne along on the surface of the lava stream.

My information concerning this portion of the Table Mountain flow is incomplete. It is known to extend almost continuously for 7 miles up both banks of the river, to Byrnes Ferry, forming irregular, plateau-like areas which break off abruptly on the river side in vertical columnar cliffs. These areas were evidently continuous at one time, but have been dissected by the river, now flowing several hundred feet below them. Andesitic breccia is reported by Turner[1] beneath the Table Mountain flow at Byrnes Ferry, and a considerable bed of similar breccia occupies the same relative position just south of McCartney Creek, about 4 miles northeast of Knights Ferry.

Near Byrnes Ferry the flow turns eastward, leaving the river and entering the edge of the Sonora quadrangle just west of Montezuma, or about latitude 37° 53′. Here it again resumes a northeasterly course, running generally parallel with the Stanislaus River at an average distance of about 5 miles to the southeast, until it enters the southern border of the Big Trees quadrangle, just west of Shaws Flat. It is this section of the flow that is known as the Tuolumne Table Mountain, a physiographical feature of considerable natural and historical interest. The old river gravels in the Neocene channel, beneath the so-called basalt, being auriferous, were actively exploited during the earlier days of mining activity. The line of famous Mother-Lode veins, passing through Angels, Carson Hill, Rawhide, and Quartz Mountain, runs beneath the lava near Rawhide, and reappears on the southern side as a heavy vein, determining a small southeast spur shown on the map. Being thus in the center of one of the most productive mining districts in the State, several references to the Tuolumne Table Mountain are found in the older geological literature of California. Trask,[2] writing in 1856, says:

> This celebrated locality, of which so much has been said and written of late, is one of the most remarkable and interesting places to be found in this State.
>
> That portion of the mountain which has so recently attracted attention on account of the placer deposits found beneath its surface is situated near the towns of Sonora and Columbia, being about equidistant from either locality. A portion of Shaw's Flat is situated immediately at its base. The superior portion of the mountain is composed of basaltic rock having the prismatic form; but in a few instances, at different points, it assumes the pentagonal shape so common to the columnar form of this rock.
>
> I have traced this basaltic overflow in an east and west direction for the distance of nearly 40 miles on its course, and it is probable that it will be found to extend to a much greater distance eastward than at present known.
>
> . . . . . .
>
> Its breadth is very variable throughout its course, in no instance, I believe, less than 400 feet, and often one-fourth of a mile. It seems to have followed the course

[1] The rocks of the Sierra Nevada: Fourteenth Ann. Rept. U. S. Geol. Survey, Part , 1894, p. 491.

[2] Report on the Geology of Northern and Southern California, Sacramento, 1856; State Senate Doc. 14, p. 20.

of a stream, filling its bed and banks, and to have flowed in this course for the entire length that it is now observable upon the surface.

To the east [*sic*] of Columbia it crosses the present bed of the Stanislaus at two different places, but what its position beyond this may be is at present unknown with any degree of certainty. From the relative position of the Stanislaus at the present time, the evidences are almost demonstrative that at the period of its occurrence it flowed into and down the former bed of this river, displacing the latter and filling up the space between its banks. The depth of the banks to the bed may be pretty accurately measured by the thickness of the basalt above that bed, which is about 100 feet on a general average.

Professor Whitney, in his volume on the geology of California, devotes several pages to a description of this portion of the flow, and of the auriferous gravels beneath the lava, accompanying his report with illustrations and sections. His account is too long to quote entire, but the following portions are pertinent to the lava flow itself, and are characterized by Whitney's usual graphic descriptive power:

One of the most striking features in the topography and geology of Tuolumne County is the so-called "Table Mountain," a name given throughout the State to the flat table-like masses of basaltic lava which have been rendered so conspicuous by the erosion of the softer strata on each side, and which now exist as elevated ridges, dominating over the surrounding country and remarkable for their picturesque beauty, but still more so on account of the important deposits of auriferous detritus which lie beneath them.

The Table Mountain of Tuolumne County is a flow of lava originating in the lofty volcanic region beyond the Big Trees of Calaveras. . . . . It comes down on the north side of the Stanislaus, forming a nearly continuous ridge, elevated more than 2,000 feet above the river. Just below Abbeys Ferry ("Abbott Ferry" on map) the Stanislaus has broken through the once continuous basaltic ridge, which has been irregularly worn away for some distance from the river, but which reappears as a continuous mountain a little southwest of Columbia and continues on the south side of the river, forming a conspicuous feature of the scenery as far as Knights Ferry, a distance of about 20 miles from the point where it crosses the river and enters Tuolumne County. As seen from a distance, this Table Mountain reveals its origin at once in the contrast between the long straight line of its upper edge and the broken and curving ones which eroded hills of the auriferous slates everywhere exhibit. Its dark color and the comparative absence of trees or shrubs on its top and sides also indicate very clearly that the material of which it is composed is very different from that of the surrounding hills.

. . . . . .

On approaching Table Mountain and examining the material of which it is composed, and the position which it occupies, it is seen at once that it is a vast lava flow, of which the upper surface remains very nearly at the level and with the form which it originally had at the time of its consolidation, while the edges and the surrounding country have been denuded and washed away, so that the topography of the region is entirely different from what it was; in fact it is almost the reverse of it. No one can deny that a stream of melted lava, running for 40 miles down the slope of the Sierra, must have sought and found a depression or valley in which to flow, for it is impossible that it should have maintained, for any distance, a position on the crest of a ridge. Nor could the valley of the Stanislaus, now 2,000 feet deep, have existed at that time, for this flow of lava is clearly seen to have crossed it at Abbeys Ferry. The whole face of the country must, therefore, have undergone an entire change since the eruption took place during which this mass of lava was poured out. . . . .

The summit of Table Mountain is occupied by a heavy bed of basaltic lava, of a very dark color and dense texture. It is occasionally distinctly columnar, and

appears to have all been poured out in one flow, as there are no partings or divisions perceptible in the mass, which in the vicinity of Sonora is from 140 to 150 feet in thickness. Its width, at a point near the Buckeye Tunnel, was found to be about 1,700 feet. The surface of the basalt is very nearly level, with a gentle slope down the valley.[1]

In his volume on the auriferous gravels,[2] the same writer summarizes his earlier account of the mountain, adds some further notes, and appends an outline map showing the approximate extent of the dissected lava flow between Abbeys Ferry and Knights Ferry. He also gives several transverse sections showing the structure of the mountain as revealed by mining operations. He speaks of the "basalt" overlying the andesite breccia, a relation which both Mr. Turner and I have confirmed at several points.

To the descriptions quoted there is little to be added concerning this portion of the flow, save to note that it attains a width of three-fourths of a mile northwest of Montezuma, and that the columnar structure is a decidedly noticeable feature of the dark crags which surround the mountain in this region, rendering it an almost impassable barrier, and its level top a secure resort for hawks and eagles. Roads skirt the cliffs on either side, but a practicable route across the line of the flow is found only where the volcanic cap has been cut through by erosion, effected by an undermining of the softer underlying rocks. The main stage road, connecting Sonora with the Great Valley, passes through such a gap about three-fourths of a mile northwest of Shaws Flat.

The extent of the general erosion that has transformed the old Neocene lava stream into the most imposing and continuous mountain mass in the vicinity is well shown in one of Whitney's wood cuts,[3] which pictures the Table Mountain from the southeast, probably near Chinese Camp, with the Bear Mountains (monadnocks) rising in the distance above its even crest line.

North of Shaws Flat, the Table Mountain flow turns westward toward the Stanislaus River. Just west of Springfield it appears to rest in a shallow trough eroded in andesitic breccia, but this relation could not be definitely established. It terminates a mile to the south of Parrott Ferry in a columnar cliff overlooking the canyon of the Stanislaus, the stream flowing a thousand feet below the bottom of the lava. Looking northward, across the river, the continuation of the flow can be seen as a dark capping upon the summit of a granite peak rising precipitously from the water's edge, just west of the ferry. The base of the latite is here 1,100 feet above the bottom of the canyon and rests directly upon the granite. The distance between the two dissevered portions of the flow is just under 1¼ miles.

From Parrott Ferry northward the flow has been dissected into a chain of separate but closely contiguous areas, which extends for 8

[1] Geological Survey of California, Vol. I, Geology, 1865, pp. 243-246.

[2] Auriferous Gravels of the Sierra Nevada: Mem. Mus. Comp. Zool. Harvard Coll., Vol. VI, 1880, pp. 131-137.

[3] Geology of California, 1865, p. 244, fig. 36.

miles along the west bank of the Stanislaus, regularly gaining in elevation, until the base of the flow at the end of this distance has an altitude of 3,000 feet above the sea and about 1,800 feet above the bed of the Stanislaus, giving a grade of about 125 feet to the mile.

Along this 8 miles the Table Mountain latite reposes upon a variety of underlying rocks. At the southern end, near Parrott Ferry, it rests upon granite. About three-quarters of a mile farther north the underlying rock is a limestone, belonging to the Calaveras formation.[1] The chief evidence for regarding this limestone as of Carboniferous age is the occurrence of Fusulina at Hites Cove.[2] A portion of the lava also rests upon the nearly vertical edges of a lenticular area of quartzose Calaveras schists inclosed in the limestone. Between the latite and the schists is a thin layer of breccia made up of fragments of the underlying schist. Still farther north the third area shown on the map is separated from the limestone by a thick deposit of auriferous gravel. Due east of the town of Vallecito the latite rests upon a bed of white rhyolitic tuff 200 feet in thickness, which in turn rests upon gravels. The rhyolite, although very plainly a tuff, is frequently divided into small columns by a rather regular prismatic parting. In one case where these columns were measured they were found to average 4 or 5 inches in diameter and about a foot in length between the joints. Columnar structure in tuffs, while not common, is not unknown. Moderni, as cited by Washington,[3] describes a columnar trachytic tuff in the Bolsena region.

To the east and southeast of Douglas Flat the relation of the latite flow to the ordinary andesitic breccia of the region and to the rhyolitic tuff is very interesting. The main ridge which separates Douglas Flat from the canyon of the Stanislaus is made up chiefly of andesitic breccia in a succession of nearly horizontal beds of great aggregate thickness, in places at least 700 feet, resting sometimes on the Bed-rock series and sometimes on an underlying bed of rhyolitic tuff. The latite flow occurs, not as a rule on the crest of this breccia ridge, but on its eastern side, overlooking the deep canyon of the Stanislaus, in characteristic flat-topped benches. These thin out on the west and overlap unconformably upon the andesitic breccia, while on the east they are terminated abruptly by perpendicular cliffs, frequently over 200 feet high, from whose edges are obtained grand views into the canyon below. At the base of these cliffs there is a bed of white columnar rhyolitic tuff, which appears to be at least 100 feet in thickness, and beneath this again a bed of auriferous gravel, varying in thickness and sometimes locally lacking. By a rather curious coincidence these benches of latite hang upon the slope at just the proper altitude to conceal the base of the andesitic breccia upon which they partly rest, the latter not appearing at the bottom of the cliffs at any point visited.

[1] See Gold Belt folios; also Lindgren, Am. Jour. Sci., 4th series, Vol. III, 1897, p. 302.

[2] Turner, Fourteenth Ann. Rept. U. S. Geol. Survey, Part II, 1894, p. 446; also Seventeenth Ann. Rept., Part I, 1896, p. 660.

[3] *Italian* petrological sketches: Jour. Geol., Vol. IV, 1896, p. 543.

From the northern end of this chain of dissected areas there is a gap of 3 miles before another remnant of latite is met with, capping a small hill just south of Mill Creek. The structure of this hill is rather complicated. On its western side the massive augite-latite is separated from the Bed-rock series by three beds of soft, light-colored tuff, while on the eastern side the place of the tuffs is taken by a sheet of gray, highly glassy lava with a pitchstone-like luster, which has been found to be a vitrophyric biotite-latite, somewhat resembling petrographically certain facies of the biotite-augite-latite forming the second flow of the series, and which is generally found resting *upon* the Table Mountain flow when the two lavas occur together. Chemical evidence seems to indicate, however, that it is perhaps a remnant of a distinct and earlier flow which preceded the Table Mountain flow.

Between the vitrophyric lava and the augite-latite cap occurs a very thin layer of reddish lava, of somewhat uncertain affinities, which has been found at only one other point, near Clover Meadow, and is there apparently beneath the Table Mountain flow. There is thus an indication that the long Table Mountain flow was not really the first of the latitic eruptions, but may have been preceded by a vitrophyric lava very similar to the biotite-augite-latite which preceded the Dardanelle flow. The field studied, however, affords no certain evidence on this point, and it must be left as a possible contingency that may meet with confirmation or denial when the geology of the Dardanelles quadrangle is fully investigated.

Immediately to the north of Mill Creek there is a small mass of the vitrophyric lava hanging upon the slope of a small spur overlooking the Stanislaus. It is evidently a continuation of the fragment south of Mill Creek, but here occurs alone, resting upon the edges of the Calaveras quartzite.

Following up the western bank of the North Fork of the Stanislaus, a small remnant of the Table Mountain flow is found about a mile and a half east of Manuel's, perched on the brink of the canyon at an elevation of about 3,200 feet and resting immediately on the granite.

A quarter of a mile farther upstream an interesting portion of the flow is encountered, which extends along the river almost continuously for 3½ miles to Squaw Hollow. The comparatively shallow drainage area of Love Creek is separated along this distance from the deeper canyon of the North Stanislaus by an even, flat-topped ridge, capped for the greater part of its length by andesitic tuff and breccia. The Table Mountain flow not only occupies the greater part of the valley of Love Creek, but also forms a distinct bench on the river side of the ridge, just below its crest. The outer edge of this bench is nearly always a vertical cliff, and the latite can generally be seen resting upon the granite. The relation to the andesitic breccia at the rear of the terrace is not easily determined. It is not always plain whether the andesite breccia is the later and rests upon the latite, as the mapping at first sight suggests, or whether the latter is really the younger rock,

which, having flowed down a channel cut through the breccia, has by a curious coincidence left its remnants lying unconformably upon both granite and breccia in such a way as to conceal their contact. In spite of its inherent improbability, there are indications which point to the latter hypothesis as the true one, especially as a similar relationship was observed east of Douglas Flat. That such a condition does obtain only a short distance away is shown at a point 1⅛ miles south of Squaw Hollow. (Pl. IV.) Here the nearly horizontal beds of light-gray andesitic breccia, with an aggregate thickness of 700 feet, are well exposed in a steep, bare slope, the lowermost bed reposing on the granite. The base of the Table Mountain flow is also very well exposed, and can be seen resting in striking uncomformity upon the eroded edges of the horizontal breccia beds, the plane of contact sloping down toward the river at an angle of about 20 or 25 degrees. The bottom of the flow is separated from the breccia by a thin layer of andesitic rubble or conglomerate, evidently derived from the underlying beds. Above this somewhat angular conglomerate comes the vesicular and more or less brecciated under surface of the massive latitic flow, passing, a little higher up, into a horizontally platy structure, which in turn is succeeded by a rude columnar parting. Although the base of the flow slopes down toward the bottom of the canyon at a considerable angle, its upper surface is more nearly level and forms a gently sloping bench, which breaks off abruptly toward the river in cliffs from 100 to 150 feet in height.

There is thus proof at this point, not only that the Table Mountain flow rests unconformably above a considerable thickness of the andesitic breccias, but that, at the time of its extrusion, the latter beds had been extensively eroded and a channel cut in them, which, here at least, was closely coincident with, though not so deep as, the present canyon of the North Stanislaus.

Near the crest of the ridge the Table Mountain flow becomes quite thin, and is overlain by biotite-augite-latite about 100 feet in thickness, which in turn is capped by about 75 feet of augite-latite, here occupying the summit of the ridge. This upper flow is lithologically nearly identical with the Table Mountain flow, but has somewhat smaller plagioclase phenocrysts, and on account of its position is correlated with the Dardanelle flow. The biotite-augite-latite occurs in three other places on the river slope of the ridge, in every case in small patches resting upon thicker masses of the Table Mountain flow. It is best seen, however, to the west of the ridge, in the little valley of Love Creek.

A few yards east of McKay's mill the attention is arrested by a low, gently arching lobe of dark-gray lava, which rises from the narrow floor of the valley with so clean and bare a surface that it appears to have been erupted within historical times. Its surface shows no sign of weathering, and is divided by cracks into rough polygonal blocks from

TABLE MOUNTAIN FLOW RESTING UNCONFORMABLY UPON BEDS OF FRAGMENTAL ANDESITE SOUTH OF SQUAW HOLLOW.

The view is taken from the east. The steep, bare slope in the foreground is andesitic breccia in nearly horizontal beds, upon whose edges the rudely columnar augite-latite can be seen resting in the upper left-hand portion of the illustration.

a foot to 2 feet in diameter. The rock cleaves most readily transverse to these rude vertical columns, the cleavage faces showing the characteristically abundant, glistening biotite crystals of the biotite-augite-latite. Upstream from McKay's mill the latite is found to fill most of the bottom of the little canyon, with a final isolated patch resting in the col at its head. As the ravine itself is excavated in granite, it is evident that it must have existed in substantially its present shape before the lava flow took possession of its stream bed. In other words, it is a remnant of a small Neocene valley. This result is startling when it is remembered that the main Stanislaus River has cut a gorge 1,000 feet deep directly across the Table Mountain flow upon which a portion of this biotite-augite-latite rests, while near Sonora the waste of the surrounding country has been sufficient to leave the same flow as a mountain mass, conspicuous for miles around. But, startling as it appears, there seems to be no avoidance of the conclusion here drawn. This survival explains why the old peneplain character is better preserved in this portion of the Sierra slope than in the foothill region; the rocks are more homogeneous and resistant, and the active erosion is largely concentrated in the deep canyon-cutting of the longer and more vigorous streams. This phase of denudation, although productive of striking results, is least calculated to obscure the peneplain character of the surface upon which it acts. It is quite probable that the present small stream of Love Creek has had its cutting power greatly decreased by the capture of its former head-water drainage by the deepening and widening of the North Stanislaus Canyon.

Near Squaw Hollow the line of the flow turns eastward and crosses the present canyon of the North Fork of the Stanislaus, another obvious instance of deep cutting since the eruption of the lavas. This canyon is not to be compared to that of the Middle Stanislaus, but some idea of its depth and the steepness of its walls may be gained when it is stated that the trail connecting the two groves of mammoth trees crosses at this point on a narrow bridge, and a horseman must travel more than 12 miles in a straight line up or down the stream before coming to another practicable crossing.

Two miles east of Squaw Hollow a remnant of the Table Mountain flow occurs resting upon a ridge of granite and surmounted by a small patch of the biotite-augite-latite. Another fragment occurs on the same ridge a little farther east. From these small areas there is a considerable gap in the continuity of the lava flows, until they are met with again, some 3 miles to the east, in the upper drainage of Griswold Creek. The most interesting occurrence here is about 1¼ miles south of Fennessy Meadow, on the divide between Griswold and Skull creeks, where a portion of the biotite-augite-latite can be plainly seen resting upon the andesite breccia, and in turn covered by a second bed of the latter. The volcanic rocks at this point cap a small elliptical hill and rest upon the basal granite of the region. At the eastern end

of the hill the latite is about 40 feet thick, and well exposed on the southern side, resting upon the breccia. Above the latite is a bed of soft, light-colored tuff, about 15 feet thick, which in turn is overlain by the ordinary andesitic breccia which caps the hill. At the west end of the hill a similar sequence is exposed, only here the latite is not more than about 25 feet thick, and rests directly upon the granite. Just to the east of the hill is a strip of augite-latite which appears to underlie the biotite-augite-latite, but the relation is not clearly shown. Other considerable masses of augite-latite occur on Griswold Creek above Fennessy Meadow, but they were somewhat hastily examined, and it is not known whether they should be correlated with the Table Mountain flow or with the Dardanelle flow.

Near the head waters of Beaver Creek the andesitic breccia surrounds an area of granite, portions of which are higher than the bottom of the breccia, indicating a considerable irregularity in the old peneplain at this place. The biotite-augite-latite occurs at three points about the edge of this inclosed area, resting on the granite at the base of the breccia, and apparently overlain by the latter. The southernmost of the three patches is overlain by a portion of the Dardanelle flow.

The line of the latitic flows crosses the main breccia ridge at this point and appears on its eastern side in the drainage area of the Middle Stanislaus. Whether the flows are really continuous under a portion of the andesitic breccias is a question that was not determined with absolute certainty. The mapping indicates such a continuance, and the hypothesis is strengthened by the fact that on the eastern side of the ridge a portion of the sloping terrace formed by the Dardanelle flow and the underlying biotite-augite-latite is occupied by a small meadow, with strong springs issuing from beneath the andesitic breccia at its rear. As such springs are not common along the sides of these ridges, save where the porous breccia beds rest upon an impervious foundation, the presumption is that the massive Dardanelle flow here passes beneath a portion of the clastic series.

To the south and east of Clover Meadow the latites are well exposed. They occupy in general the crest of the ridge already described as running eastward toward the Dardanelles, and rest with evident unconformity upon the andesitic breccias and tuffs, or directly upon the granite, as seen about a mile to the south of Clover Meadow. All three of the flows are represented on the ridge. The earliest or Table Mountain flow is the most extensive, and rests upon a rather uneven surface of the clastic andesites. It varies greatly in thickness from point to point, and has a warped and twisted surface, rendering its mapping difficult on a small scale. At the western end of the ridge, about half a mile due east of the small pond in Clover Meadow, occurs an insignificant patch of the red lava, identical with that found south of Mill Creek, and occupying a position below and apparently geologically beneath the Table Mountain flow. Near the

MOUNTAIN FLOW AND THE UNDERLYING ANDESITIC BRECCIA 1½ MILES EAST OF CLOVER MEADOW.

eastern end of the ridge the contact of the latite with the clastic andesite is finely shown (Pl. V). The lower portion of the massive flow is usually highly vesicular, and at the point shown in the illustration there is a cavity about 3 feet in height in the under side of the flow, its interior being lined with exceedingly frothy lava. At a short distance from the bottom the latite becomes less vesicular and takes on the usual platy structure, passing with increasing thickness into columnar parting. The character of the underlying andesite at this place is shown in Pl. VI. The material shows a rude stratification and the fragments are rounded or subangular, indicating that they were water deposited.

As already noted, the eastern end of the ridge falls off abruptly in a high bluff, in which are exposed over 400 feet of nearly horizontal beds, composed of andesitic sands and gravels partly consolidated. They form a part of the andesitic tuff series, but are somewhat more water-worn and better stratified than usual in this region. (Pl. VII.) The craggy masses in the upper right-hand corner of the illustration are composed of an andesitic breccia, which lies at a considerable angle and unconformably upon the stratified andesitic beds and underlies the Table Mountain flow. It appears to belong to the period of latitic eruptions, and to have immediately preceded the first of these. It has very little horizontal persistence, but is probably the equivalent of the conglomerate noted in a similar position beneath the lower latite flow, east of McKay's mill.

At the western end of a little meadow lying on the crest of the ridge, near its eastern end, the Table Mountain flow exhibits the interesting rounded forms shown in Pl. VIII. These recall certain spheroidal structures occurring in the Mesozoic basalts at Point Bonita,[1] in the Coast Ranges, although they are not so perfect as the latter. They are clearly not due to weathering and exfoliation, as the surface shown is perfectly bare of soil and exhibits only the merest traces of superficial decomposition. It is undoubtedly a structure produced during the cooling of the molten mass, and is replaced a few yards away by the ordinary columnar structure (Pl. IX). The surface shown in the illustration, Pl. VIII, is probably but little different from that of the original flow, and exhibits well its locally rolling character. That the ice at one time surmounted the ridge is indicated by the granitic bowlders which occur perched here and there upon the lavas, but it does not appear to have acted as an effective eroding agent.

At various places on the ridge the biotite-augite-latite rests upon the Table Mountain flow with an average thickness of something less than 50 feet, while on top of it again are masses of the Dardanelle flow, with an observed thickness of 100 feet. This latter rock generally shows a smaller columnar structure than the Table Mountain flow, the columns being rarely a foot in diameter and usually short and irregular.

[1] Univ. of Calif., Dept. Geol., Bull., Vol. I., 1893-96, pp. 71-114.

Probably no known area in the Sierra Nevada presents a more interesting succession of volcanic rocks than the cluster of peaks known as the Dardanelles. As a whole they have never been closely studied, and the present information has been derived merely from a short reconnaissance of the western peak, and an ascent to its summit. This peak is made up of a series of volcanic flows resting upon the granite as a basement, at an elevation of about 7,500 feet above sea. On the west side (the side shown in Pl. III) the lower member of the volcanic series is composed of several flows of olivine-basalt, aggregating from 500 to 600 feet in thickness. This basalt has suffered greater decomposition than the latites, and forms a steep, weathered slope, leading up to the base of the lofty cliffs which give the peak its striking outline. That the rocks composing this slope are true surface flows is indicated by the frequent vesicular and amygdaloidal bands from 10 to 40 feet in thickness, which are exposed in the small gullies channeling the weathered rock. The vesicles are usually lined with zeolites in the form of thin incrustations.

Resting sometimes directly upon the olivine-basalt, sometimes separated from it merely by a thin layer of volcanic conglomerate, is a thick mass of dark, columnar augite-latite, forming a vertical cliff over 400 feet in height. The lower 25 or 30 feet of the cliff face shows a very vesicular facies, becoming compact and columnar higher up. A short distance away from the mountain it could be seen that the columns became much larger some distance up the cliff, but it was not possible to determine whether this difference in size was significant of any division into an upper and lower flow, or whether the whole cliff face consisted of the Table Mountain flow. Hand specimens from the base of the cliff show a facies much like the typical Dardanelle flow, while fragments fallen from the upper portions exhibit the thoroughly characteristic features of the Table Mountain facies. The difference, however, is not greater than might easily obtain between the middle and basal portions of a single thick flow.

The conglomerate, mentioned as occurring between the olivine-basalt and the base of the latite, is composed chiefly of waterworn volcanic pebbles, some of which are identical with the underlying basalt, while others appear to be andesitic, or possibly latitic, in character. The bed is a lenticular one, about 12 feet in thickness and of small lateral extent.

Rhyolitic material was not observed on the west side of the peak, but an area of massive rhyolite is shown on the map just west of the peak and crossed by the trail going down to Highland Creek. This is the only area of undoubtedly massive rhyolite met with in the district embraced by the map. It rests immediately upon the granite, and, like the rhyolitic tuff of the region, is probably older than the andesites and latites.

Above the heavy columnar Table Mountain flow, and forming the extreme summits of the West Dardanelle, some rounded, dumpling-

ANDESITIC CONGLOMERATE UNDERLYING TABLE MOUNTAIN FLOW 1½ MILES EAST OF CLOVER MEADOW.

The illustration shows the imperfect rounding of the volcanic fragments and the rude stratification of the whole. These are outlying pinnacles left by differential erosion upon the steep hill slope.

shaped masses could be seen, which the glass showed to have the smaller columnar structure generally associated with the uppermost, or Dardanelle flow.

On the southeast side the ascent to the top of the peak is not difficult. It was found that the lowermost member of the volcanic series on this side is a rhyolitic tuff, inclosing foreign waterworn pebbles, and about 50 feet thick, probably resting on the granite, although the base was not seen. Above the tuff the same olivine-basalt already mentioned is exposed for a thickness of 150 feet. The succeeding 300 feet of vertical elevation is occupied by a very rough talus slope, composed of fallen columns from the cliffs above, which on this side show a height of nearly 500 feet by aneroid barometer. The lower 200 feet of the cliff exposed is coarsely and somewhat irregularly columnar; toward the top this passes gradually into a zone characterized by a horizontally platy structure, which in turn is succeeded by an irregularly jointed and vesicular upper portion, becoming a flow breccia at the extreme top. No evidence was found on this side of the mountain to indicate that this thickness of 500 feet is made up of any more than the single Table Mountain flow. Its bottom, however, was not seen.

On the top of this thick flow, exposed in the saddles between the three summits shown on the map, lies the biotite-augite-latite of the second flow, here 50 feet in thickness.

The summits themselves are composed of remnants of the Dardanelle flow, which on the western knob has a thickness of at least 160 feet. It shows the usual small columns and fresh bare surface, its dissection being due rather to an undermining and falling away of the columns than to its own weathering. The entire thickness of the latites here exposed is at least 710 feet, and of the entire volcanic accumulation above the granite 1,210 feet. These figures, however, are from aneroid readings, while the topographical map would indicate a total thickness of 1,400 feet. It is noteworthy that this thickness does not include any of the ordinary andesitic breccia which elsewhere occurs in such volume beneath the latites.

The Dardanelle Cone, 9,529 feet, the highest peak of the group, was not visited. It owes its name to its sharp conical summit as seen from the west, but, like the West Dardanelle, appears to be made up of horizontal volcanic rocks resting upon the granite. The lower beds are light in color, suggesting rhyolitic or andesitic tuffs.

The view from the summit of the West Dardanelle is in many ways an exceedingly interesting one. In the immediate foreground, to the west and north, lies a broad basin of bare, glaciated granite, rounded and polished by the ice, and dotted here and there with lakes or grassy meadows. To the south lies the gorge of the Middle Stanislaus—too deep and narrow for its bottom to be seen, even from such a vantage point. But if the eyes are withdrawn from what lies just below them and allowed to sweep the horizon, the attention is at once attracted by

the several peaks of similar structure to that upon which the observer stands; that is, they are made up of nearly horizontal flows or breccia beds, resting upon a granitic basement. Not only are they of similar structure, but they stand with their tops close to an imaginary plane having a noticeable slope to the southwest, the general western slope of the range, which is rendered more apparent when seen from so high an altitude. Toward the west the ridges are lower, and, as has been shown, are composed in part of the same latitic flows. To the east and northeast they are higher and less continuous, being frequently isolated peaks, and less is known of the nature of their volcanic caps. It is probable that they are in part composed of latite, as Whitney[1] mentions the occurrence of lava similar to the Table Mountain flow south of Hermit Valley. But they are probably largely made up of the ordinary andesitic breccia of the range.[2] This appears to be especially true of the ridges to the southeast across the main Stanislaus River. It is evident that in Tertiary times this portion of the range was a peneplain, or a surface of comparatively gentle relief, which at the end of the Neocene was covered by volcanic tuffs and flows. Moreover, the latite now crowning the Dardanelles can not mark the upper limit of this accumulation, for, as has been shown in the preceding pages, these lavas flowed down channels in the andesite, and were in turn covered by fresh accumulations of the same breccia. The only remnants of all this volcanic covering now visible from the summit of the West Dardanelle are a few residual peaks and ridges which, owing to a more resistant capping, or to other causes, have survived the general degradation. The picture of profound denudation, shown in the uncovering of the old granite surface and its deep trenching by such streams as the Stanislaus, would be impressive in any case, but it becomes doubly so when it is remembered that all this has taken place in post-Tertiary times.

Thus far the latitic lavas have been described as if they were confined in their distribution to the main line of flow outlined in the preceding pages. But this is not entirely the case. As shown on the accompanying map, the biotite-augite-latite occurs in small isolated areas at considerable distances from the main flow-axis, even appearing in the drainage area of the Mokelumne River, to the north of the Stanislaus Basin. It is possible that there may be a few more of these patches than have been indicated, as they frequently occur very unobtrusively near the contact of the andesite breccias with the underlying granite, and are often concealed in the heavy timber. In such situations it is generally impossible to determine positively whether the latite really underlies the andesite or vice versa. South of the Middle Stanislaus are several small areas of the biotite-augite-latite which plainly rest upon the andesitic breccias and tuffs, in most cases with evident uncon-

[1] Auriferous Gravels, 1880, p. 131.

[2] See Turner, Geology of the Sierra Nevada: Seventeenth Ann. Rept. U. S. Geol. Survey, Part I, 1896, *pp. 708–709*, for some interesting notes on this region, with views of the andesite breccia (Pl. XXXVI).

VIEW OF BLUFF WHICH TERMINATES THE RIDGE ABOUT 2 MILES EAST OF CLOVER MEADOW, SHOWING THE STRATIFICATION OF THE ANDESITIC BEDS.

The pinnacles on the left are composed of a coarse andesitic breccia resting unconformably upon the stratified tuffs and conglomerates and underlying the Table Mountain latite, which is not shown.

formity. This relation is well shown about 2 miles southeast of Mount Knight, where the latite, beginning with a point on the top of the ridge overlooking the Middle Stanislaus, runs obliquely down over the beveled edges of the nearly horizontal clastic andesite, resting finally on the schists of the Bed-rock series just above Rose Creek.

As will be seen in the section devoted to the petrography of the latites, the biotite-augite-latite has characteristics that render its distinction from a tuff not always easy. The fact that it has a wider distribution than the two undoubted massive flows, also suggests that it may have had a different origin. But the field evidence does not support the view that it is in any sense a water-deposited tuff. It is entirely devoid of the horizontal bedding characteristic of the known tuffs of the region, and on the other hand it possesses the more or less uneven upper and lower surfaces, and the ability to lie upon perceptible slopes, which are characteristic of true lava streams. It also resembles lavas in being coarsely columnar in structure, although, as has been shown, this structure may also occur in undoubted tuffs. The basal contact of the biotite-augite-latite was nowhere seen sufficiently well exposed to give a decisive answer to the question whether it is tuffaceous or massive in character.

PETROGRAPHY OF THE LATITES AND OF THE OTHER VOLCANIC ROCKS ASSOCIATED WITH THEM.

As frequently emphasized in the preceding account of its distribution, the lava composing the Table Mountain and Dardanelle flows is dark in color and basaltic in general appearance. The earlier writers, without exception, referred to it as basalt, and until very recently no reason had appeared for revising their determination. In 1895, however, Turner wrote as follows:

> The basalt of the Tuolumne Table Mountain is also a dark, heavy rock, but as may be noted below [referring to an accompanying chemical analysis] has an unusually high percentage of silica for a basalt. It is also characterized macroscopically by containing numerous cavities and tabular porphyritic feldspars which are sometimes half an inch long.[1]

In a later paper, published after the field seasons of 1895 and 1896, occurs the following paragraph:

> Tertiary trachytes are known thus far only in the area of the Big Trees sheet. They occur both as tuffs (?) and massive flows, the latter strongly resembling basalt in macroscopic appearance. They are placed with the trachytes chiefly on the basis of their chemical composition. Indeed, the Tuolumne Table Mountain basalt has so high an alkali content that it is placed in the table with the trachytes for comparison. This flow can be traced from Knights Ferry, in Stanislaus County, across the Sonora area into the Big Trees district, not far from where specimens 85 and 86 Tuolumne were collected. As the writer has only cursorily examined these trachytes, the matter of their classification will not be further considered at present.[2]

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[1] Rocks of the Sierra Nevada: Fourteenth Ann. Rept. U. S. Geol. Survey, Part II, 1894, p. 491.

[2] Further contributions to the geology of the Sierra Nevada: Seventeenth Ann. Rept. U. S. Geol. Survey, Part I, 1896, p. 729.

By way of preliminary explanation, it may be stated that both the "trachytes" and the "basalt" referred to in the foregoing citation are portions of the latitic flows which form the subject of the present paper. This separation into trachyte and basalt, it will appear, was not without excuse so long as hand specimens from somewhat widely separated localities were made the basis for such distinction, and the mere fact that lavas belonging to one chemical and mineralogical type, if not, in some cases, to one flow, could be tentatively classed as trachytes in one place and basalts in another, is not without its bearing on the question of their proper classification.

THE TABLE MOUNTAIN FLOW.

Megascopically the Table Mountain latite shows great uniformity, from the end of the flow, near Knights Ferry, to the Dardanelles, the highest point at which it has been studied. It may become locally vesicular, especially at the top and bottom of the flow, or show slight variations in the number and size of the phenocrysts, but in general the description of any one hand specimen will apply with but slight modification to any portion of the 60 miles of flow.

A specimen (1820 S. N.) from just west of Parrott Ferry, at the point where the river has cut its gorge across the line of the lava stream, may be considered as typical. This is a dark rock, of compact texture and basaltic aspect, characterized by an abundance of large glassy plagioclase phenocrysts lying in a dense, nearly black groundmass. The plagioclases are tabular parallel to the brachypinacoidal faces, a common size being about 2 mm in thickness, 8 mm in breadth, and 10 mm in length. A length of 15 mm may, however, be frequently observed. The cleavage faces, on the freshly fractured rock surfaces, always show twinning according to the albite law, and not infrequently an additional twinning following the Carlsbad law. Dark olive-green augite can be distinguished in the form of phenocrysts, but it is neither an abundant nor a conspicuous constituent as compared with the plagioclases. The rock is somewhat vesicular, the vesicles being usually elongated in the direction of flow, and occasionally filled with calcite.

Under the microscope the large plagioclase crystals are by far the most conspicuous mineral in the slide. Augite is much less abundant, but occurs in phenocrysts of considerable size and usually of irregular outlines. Olivine is moderately abundant in small, more or less idiomorphic phenocrysts up to 0.5 mm in length. The groundmass is hyalopilitic.

The large plagioclases generally show approximate crystallographic outlines, but they are often rounded and sometimes deeply embayed. Although perfectly fresh, they are apt to be crowded with inclusions of dark, glassy base, giving them a mottled appearance not unlike the

SPHEROIDAL FACIES OF AUGITE-LATITE OF THE TABLE MOUNTAIN FLOW.

At the western end of a little meadow on the crest of the ridge, about 1¼ miles east of Clover Meadow.

crystal figured by Rosenbusch[1] from a Hungarian augite-andesite. They are invariably twinned in accordance with the albite law, but the resulting lamellæ are of very different widths, ranging from those just visible up to 0.5 mm or over. The frequent combination of Carlsbad with albite twins renders the determination of the feldspars by Michel Lévy's method comparatively easy. In a section at right angles to the plane of the brachypinacoid, angles of extinction were obtained on each half of the Carlsbad twin of 14.5° and 33.5°, indicating a labradorite with about the composition Ab_3An_4. A section cut approximately parallel to the brachypinacoid and revealing no twinning showed the emergence of a slightly oblique acute bisectrix and gave an extinction angle of about 16° with the basal cleavage, the angle varying somewhat for different portions of the crystal.

Pericline lamellæ are occasionally observed in conjunction with the albite twinning.

An attempt was made to determine the specific gravity of the plagioclase phenocrysts by suspending fragments in Thoulet solution. Some very small and apparently pure grains neither floated nor sank at 2.684, but the specific gravity of particles over a millimeter in diameter was found to be about 2.651. The latter figure is undoubtedly lower than the true specific gravity of the feldspar, as it is impossible to secure fragments that are free from inclusions and yet large enough to give satisfactory determinations by suspension in a heavy liquid.

The augite phenocrysts are generally irregular and rounded in outline, but are sometimes crystallographically bounded in the prism zone. They are very pale green in color, nonpleochroic, and resemble diopside; but the extinction angle on *c* is often over 40°, and sometimes as high as 45°, and they are more properly classed as pale augite. As Zirkel[2] points out, such pale-green augites are characteristic of rocks high in alkalies, while brownish augites are more common in basalts.

The olivine, like the other minerals in the slide, is perfectly fresh, and forms small crystals, usually less than 0.5 mm in length, and showing slightly rounded crystallographic outlines. Although occurring in much smaller crystals than the augite, it appears to be nearly as abundant in the thin section, and may be regarded as an essential constituent of the rock.

The groundmass, from which the phenocrysts are distinctly differentiated, shows a rather coarse hyalopilitic structure, made up of feldspar microlites, grains of magnetite, augite, olivine, and glass. Structurally, it is very similar to the olivine weiselbergite of Rosenbusch,[3] as seen in one of Voigt and Hochgesang's thin sections. The feldspar microlites usually show distinct albite lamellæ, which extinguish at considerable angles, indicating a labradorite but little, if any, less basic than the phenocrysts. As one of the distinctive characters of the latites

[1] Mikroskopische Physiographie (3d ed.), Vol. I, 1892, Pl. XXIV, fig. 3.
[2] Lehrbuch der Petrographie, 2d ed., Vol. I, 1893, p. 281.
[3] Op. cit., Vol. II, 1896, p. 954.

described in this paper is their relatively high potash content, and as Washington[1] has described orthoclase in rocks of almost identical chemical composition from Italy and Asia Minor, pains were taken to determine whether any of the microlites were potash feldspars. But microscopical study gives no ground for believing that any other feldspar than labradorite is present. Some of the labradorite phenocrysts were observed to be bordered by an extremely narrow zone of more acid feldspar—possibly orthoclase. This, however, is not common.

The glassy portion of the groundmass appears to make up less than half its bulk. It is light brown in color, and quite turbid from the presence of very minute globulites. The magnetite occurs in small but distinct grains, rather abundantly and evenly distributed through the section. The olivine and augite grains in the groundmass differ in no way but in their small size from the same minerals in the phenocrysts, and are not to be sharply differentiated from the latter. The olivine frequently occurs as inclusions in the augite, and the latter is sometimes included in the large labradorite phenocrysts. Apatite occurs in small prisms, commonly included in the augite.

Turner[2] has given a microscopical description of a specimen (36 S. N.) collected from Table Mountain near Shaws Flat. He says:

> Microscopically the Table Mountain basalt shows large tabular feldspars, smaller augites, and numerous olivine grains in a nearly opaque groundmass, in which are very abundant feldspar microlites. This groundmass doubtless contains a large amount of magnetite, and strongly resembles some of the sections of the older basalt. There is a good deal of brownish serpentinoid substance in the groundmass. The porphyritic feldspars are polysynthetically twinned and have a corroded appearance, due to the abundant inclusions of aggregates of opaque particles, with some glass inclusions. There is also some serpentine in the large feldspars.

An analysis of this specimen is appended to his description and has been quoted in Column I of the table of chemical analyses on page 58.

Mr. Turner having kindly allowed me to examine two thin sections of this rock, it was found that it differed from most of the specimens collected at other points along the Table Mountain in the slightly greater abundance of the olivine, in the presence of the serpentinous patches, and in a rather unusual opacity in the glassy base. A single rounded crystal of slightly pleochroic orthorhombic pyroxene was noted included within a large augite phenocryst, but this mineral is very rare in the Table Mountain flow. The groundmass is hyalopilitic. The opacity of the groundmass is seen with high powers to be due to the dense crowding of minute globulites of rather peculiar character. These globulites occur also in the Dardanelle flow, and as they have been there more studied their description will be for the present deferred.

A specimen (1016 S. N.) taken on the trail passing over the top of

[1] Italian petrological sketches: Jour. Geol., Vol. IV, 1896, p. 547 *et seq.*, and On igneous rocks from Smyrna and Pergamon: Am. Jour. Sci., 4th series, Vol. III, 1897, pp. 41-50.

[2] Rocks of the Sierra Nevada: Fourteenth Ann. Rept. U. S. Geol. Survey, Part II, 1894, p. 491.

COLUMNAR FACIES OF THE AUGITE-LATITE OF THE TABLE MOUNTAIN FLOW.

About 1¼ mile east of Clover Meadow, on the crest of the ridge. The light-colored bowlders in the foreground and the larger masses on top of the lava columns are glacial erratics.

the mountain between Sonora and Tuttletown is thoroughly typical and shows particularly well the numerous inclusions in the large labradorite phenocrysts. These inclusions are usually composed of globulitic glass, with microlites of labradorite and augite, and are similar to the fine groundmass of the rock.

Northeast from Parrott Ferry the Table Mountain flow was investigated microscopically at many points, with the general result of showing great structural and mineralogical uniformity. In general, as the flow is followed higher up into the mountains the olivine becomes somewhat less abundant and sinks to crystals of smaller dimensions. The large labradorite phenocrysts, while preserving their size and characteristic mottling, seem to become progressively slightly more acid, numerous determinations by the Michel Lévy method indicating that in the more eastern portions of the flow a labradorite of the approximate composition Ab_1An_1 predominates. Apatite is a constant accessory, occurring in the groundmass and in the augites.

About 1¼ miles southwest of Collyer's a facies (1845 S. N.) occurs in which the labradorite phenocrysts are somewhat smaller than usual, the rock standing megascopically about halfway between the normal Table Mountain facies and the usually finer-grained rocks of the third, or Dardanelle, flow. A thin section shows the usual phenocrysts of labradorite, augite, and olivine. The labradorites are twinned with beautiful sharpness and vary considerably in the number of inclusions contained within them. One long crystal of irregular shape was observed to be a veritable sponge, inclosing glass and microlites of plagioclase and augite. The groundmass is hyalopilitic and contains a little carbonate scattered through it.

A specimen (1945 S. N.) from the portion of the flow 1 mile northeast of McKay's mill, shown in Pl. IV, also has somewhat smaller plagioclase phenocrysts than usual, and resembles in megascopic character the Dardanelle flow, which lies above it, separated by the biotite-augite-latite. Under the microscope, however, it shows no marked difference from other thin sections from the same flow. There are the same large labradorites mottled with glassy inclusions and showing albite twinning lamellæ combined with those of the Carlsbad and pericline laws. Augite is present in large, irregular phenocrysts and in smaller crystals with idiomorphic cross sections transverse to the prism. Olivine is distinctly less abundant and occurs in smaller crystals than in that portion of the flow near Shaws Flat already described. In this particular slide it has been almost wholly altered to serpentine, a rather uncommon condition in the Table Mountain flow. The groundmass is finer, less opaque, and typically hyalopilitic.

Across the north fork of the Stanislaus the small area 1½ miles east of Squaw Hollow presents a thoroughly typical facies (1913 S. N.), both megascopically and microscopically. The large labradorites frequently show Carlsbad twins and give extinction angles corresponding to the

mixture Ab_3An_4. They sometimes show deep and intricate embayments, and are full of the usual inclusions. The augite occurs in characteristic phenocrysts and also as small grains, which are sometimes heaped together in a manner suggesting the aggregates formed by the magmatic resorption of hornblende in many andesites. Like the Shaws Flat facies described by Turner, the glassy base is dark and semiopaque, and the slide contains small irregular patches of greenish-yellow serpentine. The latter does not show definite outlines, and is not a pseudomorph after any crystalline mineral. It permeates portions of the slide irregularly, and may fill some small vesicles. Augite and olivine are less abundant than in the Shaws Flat rock, the latter mineral occurring only in small crystals in the groundmass.

The small mass (1794 S. N.) resting upon the andesitic breccia 2 miles northeast of Ashcraft's is megascopically halfway between the typical facies of the Table Mountain and Dardanelle flows. Under the microscope it shows an equally intermediate character, and may possibly belong to the latter flow. The labradorite (Ab_3An_4) phenocrysts are fresh and sharply twinned, pericline lamellæ being not uncommon. They show the basal and brachypinacoidal cleavages in systems of fine cracks, and are comparatively free from inclusions. The other phenocrysts are augite, magnetite, and olivine, lying in a hyalopilitic groundmass with considerable globulitic glass.

As the lava showing the spheroidal forms seen in Pl. VIII has been subjected to chemical analyses, it will be described somewhat at length. Megascopically the rock (1422 S. N.) forming these spheroids is indistinguishable from specimens collected from the Tuolumne Table Mountain, 40 miles to the southwest. It shows similar tabular phenocrysts of labradorite, with here and there an irregular crystal of augite, lying in a compact dark groundmass. The plagioclases are fresh and glassy, and their glistening cleavage planes are the most conspicuous features of the freshly broken rock, and even of the natural surfaces, for the weathering has been but skin deep. A common size for these phenocrysts is about 2 by 7 by 9^{mm}, the plane of greatest extension being the brachypinacoid. They invariably show the albite twinning on the basal cleavage planes, and not uncommonly Carlsbad twinning also.

Under the microscope the thin section (Pl. XI, *A*) shows the usual phenocrysts of labradorite and pale-greenish augite with small idiomorphic olivines, lying in a very fine, even groundmass, which is typically hyalopilitic, showing flow lines of the small lath-shaped microlites around the phenocrysts. The large labradorites show the usual rounded and embayed outlines, and are mottled with abundant inclusions. The latter are usually similar to the glassy base of the rock, but more rarely a greenish serpentinoid substance. Some of the labradorites have been broken in the magma and the parts displaced, and angular fragments, probably of similar origin, are common. The

VIEW OF THE DARDANELLES FROM A HIGH POINT TO THE SOUTH, LOOKING OVER THE CANYON OF THE MIDDLE STANISLAUS RIVER.
Photograph by H. W. Turner.

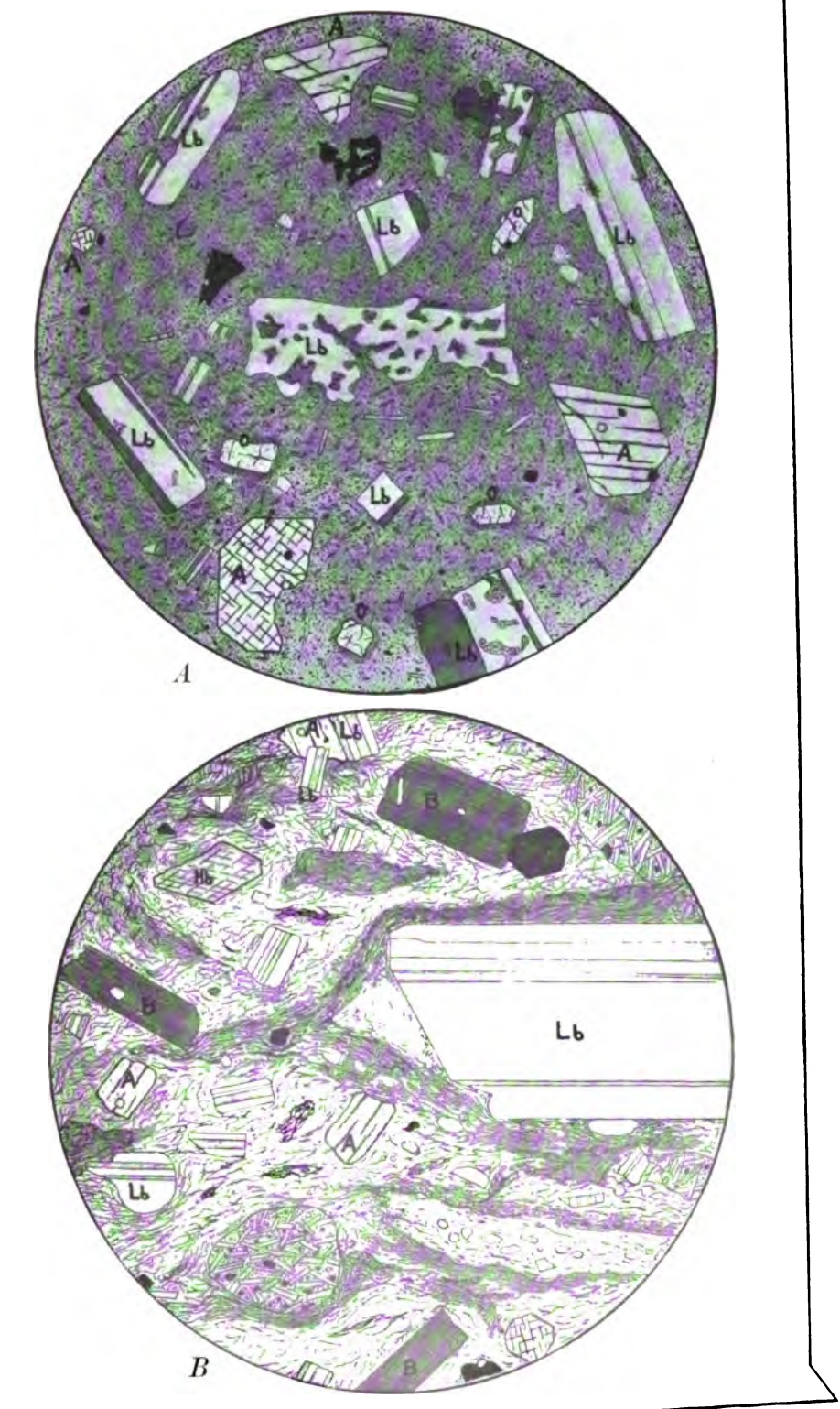
PLATE XI.

PLATE XI.

MICROSECTIONS OF LATITES (SEMIDIAGRAMMATIC).

A. Augite-latite (1422 S. N.), Table Mountain flow, showing general structure of the rock, with phenocrysts of labradorite (Lb), augite (A), olivine (O), and magnetite.

B. Biotite-augite-latite (1955 S. N.), showing eutaxitic or "piperno" structure. The drawing shows phenocrysts of labradorite (Lb), augite (A), biotite (B), hornblende (Hb), and magnetite, with included rock fragments, lying in a banded and partially brecciated microlitic glass.



MICROSECTIONS OF LATITES (SEMIDIAGRAMMATIC).

plagioclases show the usual combination of albite and Carlsbad twinning, with occasional pericline lamellæ. A determination of the extinction angles by Michel Lévy's method indicated a labradorite with the composition $Ab_1 An_1$. The specific gravity of a small, apparently pure fragment was found by means of Thoulet solution to be 2.648, which is rather light for apparently so basic a plagioclase. The augite, which is much less abundant than the labradorite, is very pale green in color, nonpleochroic, and identical with that already described. Sharply idiomorphic cross sections of the prism zone are rather more common than usual. It is frequently twinned polysynthetically on the orthopinacoid in the usual manner. The olivines are fairly abundant, but small. They are generally fresh, and show crystallographic outlines, but in somes cases they are changed to yellow serpentinous pseudomorphs. The groundmass around these olivine crystals is sometimes distinctly more finely crystalline than elsewhere, giving them the appearance of being surrounded by a faint halo. Some scattered crystals of magnetite are of sufficient size to be included among the phenocrysts.

The groundmass is truly hyalopilitic, and is made up of small slender feldspar microlites, minute crystals of magnetite, and globulites, all lying thickly crowded in a clear glass of faint brownish-violet tint. The microlites are often so crowded that it is difficult to find a portion of the section that will show no double refraction between crossed nicols. By using an immersion objective, however, and working on the thinnest edges of the section, it is possible to differentiate the glassy matrix from the feldspar microlites and to see that it is full of crystals of magnetite, ranging from those that show crystal outlines down to barely visible black specks. Associated with the magnetite grains are numerous globulites and globulitic granules of high relief and faint green tint, which are probably augite. From this it appears that magnetite, although not conspicuous with low powers, is yet quite abundant in the mass of the rock. Augite, also, is probably a more important constituent than would be indicated by its distinct crystals.

The feldspar microlites are generally too small to be determined optically, but the better-individualized ones generally show albite lamellæ with an obliquity of extinction corresponding to labradorite. Apatite occurs in rather stout, sharply hexagonal prisms.

A chemical analyses of this rock is given in Column III of the table of chemical analyses on page 58. Its specific gravity is 2.67, which is lower than one would usually expect in a rock of such dark color and compact texture.

A few hundred yards to the east of the spheroidal facies the bottom of the Table Mountain flow is exposed, resting upon clastic andesitic beds, as shown in Pl. V. The flow is here exceedingly vesicular in its lower portions, the large labradorite phenocrysts being held together by a paste *of frothy red glass*. The microscope shows the usual labra-

dorite phenocrysts full of glass inclusions. Augite was observed only as an inclusion in one of the labradorites. The cementing material is a vesicular, semiopaque brown glass, with a few labradorite microlites. The turbidity of the glass is apparently due to the oxidation of the magnetite, contingent upon the highly spongy character of the rock. The inclusions in the large plagioclases are of the same glassy nature as the matrix, while in other occurrences already described the inclusions consist of more or less individualized groundmass, thus indicating that crystallization went on in the included portions as well as in the groundmass outside the labradorite phenocrysts.

At the West Dardanelle the latite of the Table Mountain flow (1023 S. N.) is megascopically identical with the spheroidal facies (1422 S. N.) just described, although its larger structure is columnar. Microscopically it resembles rather more closely the sections from the Table Mountain near Sonora, although with considerably less olivine. The large labradorites give extinction angles corresponding to a mixture Ab_1An_1. They are full of inclusions of glass, with sometimes small crystals of augite and labradorite. The augite phenocrysts are larger and more abundant than usual. They are sometimes, like the labradorites, filled with inclusions, plagioclase laths and small patches of yellow serpentine being among the latter. The thin section also shows serpentinous patches like those described in the Tuolumne Table Mountain specimens. Olivine, however, is not so abundant, being confined to small idiomorphic crystals scattered through the groundmass. These are generally fresh, but are sometimes partly changed to serpentine.

A specimen (1030 S. N.) taken near the upper surface of the flow is rendered spongy by abundant small vesicles. Under the microscope it shows the same phenocrysts as the preceding rock, but the labradorite microlites in the groundmass are much smaller, and the rock as a whole is more glassy. With high power the glass is seen to be thickly dusted with magnetite and globulites and to show the faint violet-brown tint characteristic of the perfectly fresh glass of these rocks. In spite of the freshness of the other constituents, the olivine has all been altered to yellow serpentinous pseudomorphs.

The microscopic petrography of the Table Mountain flow has been described at some length on account of its interesting chemical character, and for the reason that such a course seemed desirable in dealing with a flow so greatly dissected. It is seen that in its superficial appearance and in the presence of olivine the augite-latite resembles the basalts; in the character of the augite and plagioclase, in the degree of preponderance of the feldspathic constituents, and in the hyalopilitic structure of the groundmass, it is more closely related to the andesites; lastly, in the fine dissemination of the magnetite, in the abundance of microtine phenocrysts, and, above all, in chemical composition, it shows certain analogies with the trachytes. No potash feldspar has been detected in any of the thin sections studied, except,

possibly, as a very narrow fringe on some of the labradorite phenocrysts, and even this seems to be the exception rather than the rule.

THE BIOTITE-AUGITE-LATITE.

As already indicated in the account of its occurrence, considerable difficulty was experienced in deciding whether this volcanic rock was a true flow, like the Dardanelle flow above it and the Table Mountain flow beneath it, or whether it should be classed as a tuff. In spite of the fact that it frequently shows the presence of fragmental material the rock is regarded as constituting a flow, for reasons that can be better appreciated after a petrographical description.

The facies occurring within the drainage of Love Creek, about 3 miles south of Big Trees post-office, is a thoroughly typical one. A specimen (1882 S. N.) taken just north of the road, about a mile southwest of McKay's, shows a bright-gray rock, that sparkles brilliantly on fresh surfaces, from the numerous crystals of biotite. In contrast to the Table Mountain augite-latite upon which it lies, this rock has a harsh or trachytic feel and is somewhat porous. Besides the biotites, the fine, and evidently glassy, groundmass holds small phenocrysts of clear sanidine-like feldspar and fragments of dark glass and of glassy volcanic rock. Some of the black glass inclusions are irregular and somewhat angular in outline, while others appear to be drawn out into thin lenses. These lenses, together with the biotite crystals, have a tendency to lie horizontal, so that the lava cleaves most readily along a plane parallel with the top and bottom of the flow. This arrangement is by no means universal, however, for the biotite tablets are found in all positions. These latter are from 1 to 2 ^{mm} in breadth and sometimes 0.5 ^{mm} in thickness. They have sharp crystallographic boundaries, the narrow planes of the prism and clinopinacoid reflecting the light nearly as brilliantly as the basal planes.

The thin section shows that the greater part of the rock is made up of a light-brown glass, with a suggestion of violet in its peculiar tint. Scattered about in this glassy matrix are abundant phenocrysts of plagioclase and biotite, a few broken or irregular crystals of augite, crystals of magnetite and apatite, and fragments of more or less glassy volcanic rocks.

The plagioclases usually show beautifully sharp twinning in accordance with the albite law, and some show both albite and Carlsbad twinning, with occasional pericline lamellæ. The Carlsbad-albite twins give extinction angles corresponding to labradorite of the composition $Ab_3 An_4$. There is no sanidine present, and the index of refraction of all the plagioclase, as determined by Becke's method, is distinctly greater than the balsam of the slide, which is about 1.540. The outline of the plagioclases is sometimes irregular and angular, sometimes rounded, and sometimes in part defined by crystallographic planes.

The biotite is abundant and in sharply bounded hexagonal tablets.

It is bright chestnut brown, with the usual strong absorption and small axial angle. It frequently includes prisms of apatite.

Augite is not abundant, and rarely shows crystallographic outlines. It is very pale green, and in no way distinguishable from that in the Table Mountain flow, already described.

A green hornblende is quite charactistic of this rock, occurring in nearly every slide of the biotite-augite-latite, but always in strictly accessory amount. It is usually in small shreds or irregular fragments, of which not more than two or three are found in any single thin section. In only two cases were prismatic cross sections seen with anything like idiomorphic outline, the best of these being shown in Pl. XI, *B*. The optical orientation is: $\mathfrak{a} = a$, $\mathfrak{b} = b$, and $\mathfrak{c} : c =$ at least 11°. The pleochroism is: $\mathfrak{a}$, faint yellow; $\mathfrak{b}$, dark brownish green, and $\mathfrak{c}$, dark green. The absorption is: $\mathfrak{a} < \mathfrak{b} < \mathfrak{c}$.

Magnetite occurs in good-sized grains in the glass, sometimes attached to the anhedra of labradorite and augite, and frequently including prisms of apatite. The latter mineral also occurs isolated in the brown glass in well-developed prisms.

The sharply bounded rock inclusions, as seen in the slide, are usually of small size, less than 0.5 mm in diameter, and rounded in outline. They consist of fragments of andesitic or latitic groundmass, generally indistinguishable, in such small areas, from facies of Table Mountain and Dardanelle flows. They sometimes contain phenocrysts of labradorite like those occurring in the inclosing rock. The glass base of these inclusions is usually gray and globulitic, but sometimes clear and pale brown, like that making up the mass of the section. In one case a rounded inclusion was observed with a central portion composed of labradorite microlites and gray glassy base, and a peripheral zone of similar microlites lying in a clear, light-brown glass.

An examination of the isotropic matrix which makes up the mass of the rock shows it to be by no means homogeneous. It is a confused mixture of shreds and strings of light-brown, translucent glass, with other portions which are rendered dark and turbid by microlites and globulitic dust. Sometimes these lighter areas are sharply bounded and resemble inclusions, at other times they fray out imperceptibly into the groundmass, or are drawn out in long flamboyant tongues. Some of the light-brown patches contain plagioclase microlites, and such portions are not always sharply separated from the nonmicrolitic areas. The whole aspect of the thin section suggests that the development of a fluidal structure was followed by flow brecciation on a minute scale, giving as a result a rock that is in some respects not unlike a tuff. That the rock is not an ordinary tuff is indicated by the close affinity shown between the inclusions and the including matrix, by the absence of distinctly foreign material, by the inclusion within areas of homogeneous brown glass of labradorite phenocrysts exactly like those which occur in the finely brecciated portions, and, lastly, by inclusions of the same light-brown glass within such phenocrysts.

On the supposition that the rock, if a clastic tuff, must owe its present induration to the presence of a considerable proportion of opal among the isotropic material, a weighed portion of the finely powdered rock was boiled in a platinum dish for two hours with a 10 per cent solution of sodium carbonate. The dish was allowed to stand for nineteen hours, again heated, the liquid filtered off, and the silica determined in the usual way. The amount soluble under these conditions was only 1.6 per cent.

A specimen (1877, S. N.) from the coulée-like mass half a mile north of McKay's, already described, is slightly darker in color than the foregoing, and, while plainly containing inclusions, has every appearance, both in the field and in the hand specimen, of being a glassy lava and not a tuff.

At first glance the thin section looks tuffaceous, but closer examination shows that the shreds of violet-brown glass, instead of behaving as rigid clastic fragments, frequently curve around the phenocrysts and inclusions in well-marked flow lines, or conform to their shape. The glass has a rather more distinct violet tint in this section, and is a little more abundant, than in the one just described. There is also a little more augite. The specific gravity of the rock is 2.47.

One mile northeast of McKay's, on the river slope of the ridge, the biotite-augite-latite (1944 S. N.) resembles megascopically that first described (1882 S. N.), but shows many long-drawn-out lenses of dark glass. Under the microscope it shows comparatively few phenocrysts or inclusions and a large proportion of the faint violet-brown glass. One small fleck of green hornblende occurs in the slide.

The latite of the elliptical area (1977 S. N.) shown on the map 1¼ miles a little west of south from Fennessy's, and overlain by andesitic breccia and tuff, is light gray in color, with a somewhat more earthy texture than usual, and less biotite. Under the microscope it shows the usual characteristic features, although the biotite is not quite so abundant. There are a few fragments of the green hornblende present. The shreds of pale-brown glass show some flow structure and are bent around the phenocrysts and included fragments.

A specimen (1955 S. N.) taken near the southern end of the inclosed area of granite, about halfway between Fennessy and Clover meadows, is a light-gray facies with abundant feldspar phenocrysts, but not much biotite. In thin section (Pl. XI, *B*) this rock appears thoroughly typical. The glass, which makes up the greater part of the slide, is brown and turbid, but shows eutaxitic banding, with excellent flow structure. In this glass lie the phenocrysts of plagioclase, biotite, and augite, with the usual fragments of volcanic rock. The plagioclases are twinned with beautiful sharpness, and several readings on albite-Carlsbad twins indicated a labradorite a trifle more basic than Ab_3An_4. The biotite is rather more abundant than the hand specimen indicates, and occurs in the usual *tablets* with inclusions of apatite. The augite occurs sometimes *in isolated* fragments, or anhedra, and sometimes intergrown

and partly surrounded by the labradorite crystals. One sharply idiomorphic section of the green hornblende occurs in the slide, being cut transverse to the prism and showing the usual amphibole outline and cleavage. Magnetite is in crystals and aggregates up to 0.5^{mm} in diameter, and, like the augite and biotite, frequently includes apatite crystals.

At a point 3¾ miles southwest of Clover Meadow, and a little over 1 mile west of the bold spur marked *7100* (feet) on the map, occurs a dark-gray facies (1420 S. N.), with the usual phenocrysts of microtine and biotite. It contains small rock fragments, but has on the whole the appearance and consistency of a lava rather than a tuff. The microscope shows the usual structure of these rocks, with the characteristic brecciated eutaxitic glass. The latter is brown and more turbid than is generally the case, and is probably somewhat weathered. Phenocrysts of feldspar are fairly abundant. They are sometimes broken and angular and occasionally slightly embayed, but they often preserve their original crystallographic outlines. Combination twins, according to both albite and Carlsbad laws, are common, and the plagioclase is labradorite. The phenocrysts are generally rather free from inclusions, and show the basal and brachypinacoidal cleavages unusually well. The other phenocrystic minerals are biotite, augite, and magnetite. Apatite occurs in small prisms included in all the other minerals.

Some of the bands and shred-like patches of brown glass show a striking mottled appearance, produced by thickly crowded round spots of shadowy outline, surrounded by darker-brown rims. The lighter central portions of these spots show an obscure radial arrangement, as if from a very imperfect spherulitic structure. No distinct microlites can be made out, however, although there is some slight double refraction between crossed nicols. The usual inclusions of latitic (?) groundmass with lath-shaped plagioclases occur in this facies, but the character of the surrounding matrix, with its fluxion phenomena, precludes the idea of the rock being a tuff. An analysis of this facies is given on page 58, Column VI of the table.

A mile southwest of the little pond in Clover Meadow is a remnant of the biotite-augite-latite (exaggerated on the map), resting upon the andesite breccia. It is very similar in appearance to the facies just described, but shows marked flow structure, which is brought out by atmospheric etching on exposed surfaces. Long-drawn-out and parallel lenses of nearly black glass are noticeable in the hand specimen (1948 S. N.). Under the microscope it is noteworthy for its fine large phenocrysts of labradorite (Ab_3An_4) and biotite and the wavy and contorted areas of clear, light-brown glass. Augite is also present among the phenocrysts, and, what is not known elsewhere in this rock, a few crystals of orthorhombic pyroxene and some scattered grains of olivine. The orthorhombic pyroxene occurs in stout prisms, rounded at the

ends, and up to 0.5 mm in length. It is distinctly pleochroic, with strictly parallel extinction and low double refraction, and is readily distinguished from the pale-green, nonpleochroic augite. It is probably enstatite or bronzite, and it appears to be identical in pleochroism and double refraction with the orthorhombic pyroxene in the so-called enstatite-porphyrite of the Cheviot Hills. The olivine is in small irregular grains, and not abundant; but its presence is interesting, as it is rare to find biotite, orthorhombic pyroxene, and olivine all present in an effusive rock of intermediate composition. The green hornblende, frequently referred to as a characteristic accessory in the rock of this flow, occurs both in the glassy part of the section and in one of the included volcanic fragments. There are also present the usual prisms of apatite and a little magnetite.

The large labradorites are often intergrown with the augite, showing that the latter mineral is the younger. All the phenocrysts occur both in the clear brown glass and in the turbid, confused, and microlitic matrix between the clearer streaks. The apatite is included in the glass and in all the larger phenocrysts save the olivine. The more or less rounded fragments of volcanic rock in the section are plainly locally inclusions, but they show a mineralogical resemblance to the rock in which they are inclosed and may not have been derived from a wholly foreign source. Some of them show only very small feldspar microlites embedded in a brown glass like that so abundant in the inclosing rock. One compound inclusion was noted which consisted of several small rounded fragments of microlitic brown glass inclosed in a similar fine groundmass of slightly different color. This strongly suggests that the greater part of the inclusions in the biotite-augite-latite are not foreign material, but represent portions of the magma, which, having attained a certain degree of crystallization, were brecciated by the movement of the lava stream and disseminated through its more glassy portions.

A specimen (1435 S. N.) from the ridge just south of Clover Meadow is a light-gray rock with phenocrysts of biotite and microtine and small rounded fragments of volcanic rock, lying in a fine light-gray and somewhat porous groundmass. This is probably the most tuffaceous facies in external appearance of the whole flow. Under the microscope it shows the usual phenocrysts of labradorite, biotite, and augite in a matrix made up of light-brown glass. The proportion of glass in the slide is larger than usual and has a fine shred-like character. It would perhaps be impossible to determine satisfactorily from a microscopic examination of this slide whether it should be classed as a tuff or not. Some of the shreds of glass, however, are molded to the form of the phenocrysts. A small fragment of green hornblende was observed isolated in the glass, while another crystal, partially resorbed and surrounded by a dark granulated border of augite and magnetite, was seen in one of the fragmental inclusions.

An inclusion (1436 S. N.) of much larger size than any observed by me was found by Mr. H. W. Turner in the biotite-augite-latite just described. It measures about 6^{cm} in diameter and is rather angular in outline. It is a hard, compact rock, light gray in color, showing small phenocrysts of plagioclase and augite, and is apparently an andesite. Under the microscope it shows phenocrysts of plagioclase, augite, and orthorhombic pyroxene, with moderate-sized grains of magnetite, lying in a very fine hyalopilitic groundmass. The plagioclases are labradorite, apparently a little more basic than $Ab_3 An_4$. The albite twinning is not so regular as in the latites, and the combination with the Carlsbad law not quite so frequent, but with the pericline law more so. They frequently show zonal structure with undulatory extinctions, especially in brachypinacoidal sections. The phenocrysts are usually small, few in the section being over 1^{mm} in length.

The orthorhombic pyroxene occurs in nearly colorless crystals of prismatic habit up to about 0.75^{mm} in length, usually with more or less rounded or irregular ends. Cross sections of the prism show rectangular outlines with slightly truncated corners, due to the dominant development of the brachypinacoid and macropinacoid. The prismatic cleavage is well developed, while the macropinacoidal cleavage is indicated only by a few fine cracks. The extinctions are always parallel to the traces of the pinacoids. Sections transverse to the prism show the emergence of a bisectrix, with a large axial angle. By comparison with the interference figures given by longitudinal sections, and by using the method given by Michel Lévy,[1] it was determined that this is the acute bisectrix. The optical orientation is: $a = \mathfrak{a}$, $b = \mathfrak{b}$, and $c = \mathfrak{c}$. The mineral is therefore optically positive. The index of refraction is not noticeably different from that of the monoclinic pyroxene in the slide, but the double refraction is much lower, ranging from gray to pale straw-yellow. The pleochroism is distinct: $\mathfrak{a}$ = very pale brown $\mathfrak{b}$ = very light yellow, and $\mathfrak{c}$ = pale green.

From the foregoing description it is seen that the pyroxene has the optical orientation of enstatite or bronzite; but the distinct pleochroism and large axial angle point rather to bronzite than to enstatite.

This inclusion is accordingly a bronzite-augite-andesite, identical with specimens that will be described from the underlying andesitic breccia, and was probably caught up (with other similar ones noted at the same locality) by the latite from the clastic beds over which it flowed.

The general microstructure of the biotite-augite-latite appears to approach very closely to the *eutaxitic* structure as the term was first employed by Fritsch and Reiss,[2] who applied it to certain facies of phonolites, andesites, and trachytes possessing some resemblances to

[1] *Les minéraux des roches*, Paris, 1888, p. 95.

[2] *Geologische Beschreibung der Insel Tenerife*, Winterthur, 1868, pp. 414–422; also abstract in *Neues Jahrbuch für Min., etc.*, 1868, pp. 752, 849–852.

clastic rocks and inclosing undoubted clastic fragments. They distinguished *agglomerate lava*, in which the structure was supposed to be due to a partial refusion of clastic material, from *piperno*, in which portions of the magma in different stages of crystallization are brought into juxtaposition by the motion of the flow. Common usage, however, has somewhat altered the original application of the term *eutaxitic*, so that it frequently implies merely a fluidal banding brought about by alternating streaks of microfelsitic and clear glass,[1] or is even used as "a general name for banded volcanic rocks."[2] That such can hardly have been the earlier application of the word appears from the discussion that has centered about the original *piperno* of Pianura in the Phlegræan Fields, near Naples, a rock that Fritsch and Reiss took as the second type of eutaxitic structure, and which appears to resemble in some ways the biotite-augite-latite of California. Luigi dell' Erba[3] considers this rock a tuff, but the greater number of petrographers have regarded it as a lava flow. Zirkel[4] refers to it as a sanidine trachyte with eutaxitic structure, remarking that Luigi dell' Erba's view is not even probable, while Rosenbusch[5] cites it as an example of his Ponza type of the trachyte family. Such a discussion could scarcely have arisen were the structure concerned a simple banding such as is observed in many vitrophyres, and which no petrographer could for a moment regard as indicating a tuffaceous origin. Küch,[6] following the terminology of Reiss, describes both kinds of eutaxitic structure, the agglomerate lava and the piperno, as occurring in the dacites and andesites of Colombia. The latter form is particularly abundant, and Küch remarks that it is at times impossible to distinguish the two varieties, as the piperno often contains included fragments of other andesites. Wichmann,[7] in describing an augite-mica-andesite from the Indian Archipelago having a structure apparently nearly identical with that of the biotite-augite-latite of the preceding pages, refers to it as having piperno structure; and there seems to be little doubt that this latter name, as used by the petrographers cited, expresses accurately the structure of the second flow of the Sierra Nevada latites.

When, on the other hand, a thin section of the last-named rock is compared with that of a lava having typical flow banding—as, for example, the beautiful vitrophyre of San Lugano, in the Tyrol, or the pitchstone-vitrophyre occurring between Lake Lugano and Lago Maggiore, both of which, according to Rosenbusch,[8] often show eutaxitic

[1] Zirkel, Petrographie, 3d ed., Vol. I, 1893, p. 465.
[2] Kemp, Handbook of Rocks, New York, 1896, p. 136.
[3] Giornal di Mineralogia, etc., Vol. III, 1892, pp. 23–54.
[4] Loc. cit., Vol. II, p. 796.
[5] Mikroskopische Physiographie, 3d ed., Vol. II, 1896, p. 766.
[6] Geologische Studien in der Republik Colombia, I Petrographie, 1. Die vulkanischen Gesteine, Berlin, 1892, pp. 84–86.
[7] Petrographische Studien über den indischen Archipel, abstract in Neues Jahrbuch für Min., etc., 1897, Vol. I, p. 283.
[8] Loc. cit., p. 698.

facies—the chief difference seems to lie in a greater irregularity and brecciation of the bands in the latite, and in the presence of included rock fragments.

In looking over the large collection of volcanic rocks brought from Asia Minor by the Assos Expedition, and now at Harvard University, it was found that the peculiar structure of the biotite-augite-latite was exactly reproduced in a specimen (A. E. 310) from near the Hot Springs of Touzla, in the southwestern part of the Troad. This specimen, as Mr. J. S. Diller very kindly informed the writer, "belongs to the lower portion of a flow of rhyolite, near its contact with the underlying tuff. The rhyolite some distance away from the contact is deep flesh red. Near the contact it is frequently black and glassy, inclosing many fragments of the tuff over which it flowed." The hand specimen shows a light-gray, very glassy rock, with streaks of dark glass and abundant angular glassy inclusions of light-buff color, together with small, slightly rounded volcanic fragments, resembling superficially those in the latite.

Under the microscope the similarity of structure is remarkable. The light-brown glassy streaks, alternating with microlitic patches, show the same confused and brecciated appearance as in the latite. Phenocrysts of biotite and feldspar are abundant, and there are numerous small rounded inclusions of some andesitic rock. The structural resemblance between the Touzla rock and the biotite-augite-latite is so close that only a critical investigation of the phenocrysts and inclusions would serve to distinguish an unlabeled thin section of the former from one of the latter. To make the resemblance still closer, no sanidine was seen in the Asia Minor rock, all the phenocrysts in the thin section being plagioclase (andesine or labradorite).

Another specimen (A. E. 531) which, according to Mr. Diller, is from "one of the large flows of rhyolite forming the plateau that lies between the Touzla River and the southern coast of the Troad, west of Assos," shows a very similar structure, while specimens from near Baba-galessi (A. E. 559 and A. E. 560) exhibit gradations into nearly or quite typical unbrecciated flow-banding.

The object of this comparison is not to show that these specimens from the Troad are chemically or mineralogically identical with the biotite-augite-latite, but merely to draw attention to their *structural* identity, and the fact that they occur as true flows and not as tuffs.

As an historical illustration of the difficulty that sometimes exists in distinguishing a tuff from a massive lava may be recited the case of the so-called "peperino" near Viterbo, in Italy, which, according to Washington,[1] is probably a tuff, although it possesses some apparent flow structures, and has been by earlier investigators frequently designated a massive rock.

There has been mentioned the occurrence near Mill Creek of a vitro-

[1] Italian petrological sketches, II: Jour. Geol., Vol. IV, 1896, pp. 838-840.

phyric lava which, though underlying some augite-latite belonging apparently to the Table Mountain flow, yet resembles the biotite-augite-latite that usually rests *upon* the latter flow. Megascopically this rock (1866 S. N.) is a gray, extremely brittle glass with a pitchstone-like luster. It is speckled with a few minute feldspar phenocrysts and shows streaks of black glass and also lighter-colored glassy patches resembling inclusions.

Under the microscope the thin section, consisting chiefly of pale violet-brown glass, shows the eutaxitic structure already fully described, but, as might be expected from the megascopic appearance of the rock, approaches a little more nearly the ordinary flow structure of the vitrophyres. This glass contains numerous angular (rarely rounded) fragments of labradorite (Ab_3An_4), less abundant anhedra of pale-green augite, a few flakes of biotite, and an occasional prism of orthorhombic pyroxene. Most of the slides examined also show one or two shreds of green hornblende. Apatite occurs in small prisms, especially as inclusions in the augite, and there are also a few grains of magnetite present. Like the typical biotite-augite-latite, this facies frequently shows small rounded inclusions of volcanic rock consisting of small microlites of plagioclase in a glassy base, but it differs from all the known occurrences of the former in being more glassy and in the paucity of biotite. A chemical analysis of this rock will be found in Column VII of the table of analyses on page 58; it will be seen to have more silica, and less lime, magnesia, iron oxides, and alumina, than the other latites.

Immediately above the facies just described, and also at Clover Meadow, is a rather peculiar lava (1867 S. N. and 1428 S. N.) of light brick-red color, containing a few small empty cavities, but of generally compact texture and speckled with small phenocrysts or fragments of glassy feldspar. In its general aspect the rock is rhyolitic, although differing from the ordinary white rhyolites of the district, which, as far as known, are all older than any of the andesitic breccias. Under the microscope the rock shows phenocrysts of feldspar, frequently broken and angular, with occasional flakes of biotite, lying in a reddish, turbid, microfelsitic groundmass. The feldspars are all plagioclase, and some of the sharply twinned individuals give extinction angles indicating labradorite as basic as Ab_3An_4. The matrix in which they lie has its original structure obscured by secondary silicification and by the separation of ferric oxide, but appears to show some remnants of the vitrophyric structure observed in the preceding rock. There are apparently the same patches of bent and contorted glass, with occasional small rounded inclusions of volcanic rock. A partial chemical analysis of this red lava is given in Column IX of the table of chemical analyses, page 58. It is higher in silica than any of the latites, but too low for a typical rhyolite. The amount and relative proportions of the alkalies, too, give no very definite information as to its proper posi-

tion, and it is uncertain whether it should be classed as a somewhat weathered superficial portion of the vitrophyric latite below it, or whether it is a very thin flow belonging rather with the rhyolites. The former supposition, however, seems much more probable, as in the latter case it would indicate a rhyolitic eruption of much later date than that of the normal white rhyolites and rhyolite tuffs which lie at the base of the whole Neocene volcanic series. For this, however, there is no evidence other than the two widely separated and insignificant patches of red lava just described, which is certainly not a typical rhyolite, and does resemble the rather acid latite (1866 S. N.) just beneath it.

THE DARDANELLE FLOW.

The rock of the youngest of the three flows resembles very closely that of the oldest or Table Mountain flow, and this resemblance is in a few cases so close that it would be impossible to say to which flow a given hand specimen belonged. Considered in their typical development, however, the two facies are fairly distinct. The augite-latite (1260 S. N.), forming the extreme summits of the West Dardanelle, may be taken as a typical facies of the Dardanelle flow. This is a dense, nearly black rock, ringing clearly under the hammer and breaking with a clean, slightly conchoidal fracture. The broken surfaces show clear glassy phenocrysts of plagioclase, resembling those of the Table Mountain flow, but smaller, sharper, and less abundant. Their basal cleavage faces show albite lamellæ, frequently combined to form Carlsbad twins. Close inspection will generally reveal a few small phenocrysts of augite, but the plagioclases are the only conspicuous megascopic crystals. They lie in a very compact, nearly black groundmass, in which a good lens can detect only a few feldspar microlites.

The microscope shows phenocrysts of labradorite, augite, and olivine, with apatite and magnetite, lying in a light-brown hyalopilitic groundmass. The labradorites are the largest and by far the most abundant phenocrysts in the slide, but are rarely more than 5^{mm} in length. They are fresh and sharply twinned, but often carry inclusions of glassy base, much as do the larger phenocrysts of the Table Mountain flow, and occasionally include small augites. They are usually tabular parallel with the brachypinacoid, and the prevailing section is lath-shaped. Observations on albite-Carlsbad twins by Michel Lévy's method gave extinction angles indicating a labradorite of the composition Ab_1An_1. The outlines of the phenocrysts are generally sharper and less embayed than in the Table Mountain flow.

The augite is identical with that in the latter flow, but is in smaller crystals and shows a greater tendency toward sharpness of crystallographic outline, especially in the prism zone.

The olivine occurs usually in idiomorphic crystals of small size scattered through the groundmass, but occasionally one of larger size is met with

The hyalopilitic groundmass shows sharp, clear feldspar microlites, with more or less flow structure, lying in a light-brown glass. These plagioclases usually show albite twinning with extinction angles corresponding to labradorite. Bifurcated ends are common. The brown semiopaque glass is quite abundant, and makes up a considerable part of the section. It shows a rather noticeable fine mottling, suggesting an incipient spherulitic structure and apparently produced by the crowding together of very minute brown globulites. The magnetite, instead of being minutely disseminated through the glass, as is common in these rocks, forms small crystals and aggregates readily seen with low power.

The specimen just described was taken from the highest point of the peak. A second (1024 S. N.) from near the bottom of the same flow was very similar in thin section, but is slightly weathered. The glass is gray instead of brown, is finely globulitic, and has the magnetite a little more finely disseminated. Apatite, in small prisms, occurs in both slides.

A hand specimen (1421 S. N.) from the summit of the ridge, one-half mile east of Clover Meadow, is megascopically identical with that just described. Under the microscope the chief differences to be observed are a more pronounced flow structure and a slightly greater abundance of augite, olivine, and apatite. The labradorite phenocrysts are more basic, readings on albite-Carlsbad twins indicating a composition near Ab_3An_4. The widths of the albite lamellæ are very variable. The augite phenocrysts occur in stout prisms, very pale green in color, generally crystallographically bounded in the prism zone, but rounded on the ends. Extinction angles were obtained, of $c:\mathfrak{c} = 45°$. The largest augite phenocryst in the slide is less than 2 mm in length. The olivine is in small, sharply idiomorphic crystals, and in larger anhedra from 0.5 mm to 1 mm in diameter. Apatite is noticeably abundant in rather stout, well-formed prisms, both in the augite and in the groundmass. This is evidently a somewhat more basic facies than that on the summit of the West Dardanelle.

The most interesting facies (1419 S. N.) of the Dardanelle flow occurs 3¾ miles southwest of Clover Meadow, at the point where the latites pass under a portion of the andesitic breccias to the west. Megascopically the rock resembles very closely the rocks just described, but the groundmass is apparently slightly more crystalline.

Under the microscope it shows the usual phenocrysts, lying in a groundmass that is distinctly more crystalline than the preceding, and recalls certain facies of the Table Mountain flow. The plagioclases are beautifully twinned according to the albite, together with the Carlsbad, and occasionally the pericline, laws. The extinction angles (30° and 13.5°, 29° and 15°) on albite-Carlsbad twins, cut in a zone perpendicular to the twinning plane, indicate a labradorite somewhat more basic than Ab_3An_4. Some of the larger crystals have glassy inclusions, as in the Table Mountain flow. The specific gravity of these labradorite

phenocrysts, determined by suspending a small fragment in Thoulet solution, is 2.667, which is rather low for a labradorite of such basicity as the extinction angles indicate.

The augite is identical with that already described. Sharply idiomorphic cross sections of the prism zone are frequent, and often show twinning on the orthopinacoid. Extinction angles were measured up to $c : \mathfrak{c} = 44°$. Olivine is present only in very subordinate amount.

The groundmass consists of well-developed lath-shaped microlites of plagioclase and small crystals of augite, olivine, and magnetite, lying in a gray cloudy glass. The great preponderance of the feldspars, both in the groundmass and among the phenocrysts, is a striking characteristic of the slide. The lath-shaped feldspars, which are thickly crowded together, are generally twinned, and have extinction angles corresponding to labradorite. When the section is examined with low power and crossed nicols it is very difficult to make out any glass. The spaces between the distinctly lath-shaped plagioclases nearly all show more or less double refraction, the only parts remaining dark being such as are already rendered nearly opaque by thickly crowded globulites. By using an immersion objective, and focusing up and down in the section, it appears that the labradorites of the groundmass are really tabular parallel with the brachypinacoid, and that these faintly doubly refracting portions of the slide are the result of an overlapping of glass and approximately brachypinacoidal sections of labradorite. They generally show the emergence of an acute bisectrix or optic axis in convergent light, which, combined with the fact that they seldom occupy the full thickness of the thin section, is sufficient to account for their low double refraction and rather uncertain extinctions. Naturally they do not show the albite twinning. It was at first supposed that they might be orthoclase, or at any rate a different feldspar from the well-defined labradorite laths, but careful focusing showed that all gradations could be traced from sections of labradorite cut at right angles to the plane of greatest extension, and therefore showing sharp albite twinning and usually occupying the full thickness of the slide, to those cut at an oblique angle and showing more shadowy lamellæ and less distinct lath-shaped outline, and finally to sections cut at only a very small angle with the brachypinacoid, occupying but a fraction of the whole thickness of the section, or thinning out to a feather-edge, and consequently showing no twin lamination and low double refraction.

The glass in which these well-developed plagioclases lie is in itself clear and colorless, but is usually crowded with dark globulites which render it nearly opaque with low or moderate powers. By using Becke's method the clear glass shows a lower index of refraction than the balsam, although the observation is difficult to make on account of the abundant globulites. With a No. VII Seibert immersion lens these *globulites*, which appear like black, opaque dust particles with low

powers, are in part transparent, and composed of a pale greenish substance of high refractive index. Within this substance is frequently a smaller black dot which remains opaque and is probably magnetite. In their general appearance the globulites with dark central spots recall the well-known cells seen in micro-preparations of hyaline cartilage. Not all the globulites, however, are compound. Some are wholly transparent, while others are wholly opaque. It is thought that the transparent greenish substance is probably augite.

A portion of this rock was finely powdered and passed through a No. 120 sieve. The fine dust was sifted out through a piece of linen and the remaining powder washed, dried, and placed in Thoulet solution of about 3.15 sp. gr. A powder at once fell which consisted of augite, olivine, and magnetite. Upon dilution to sp. gr. 2.626, about half the remaining powder came down. This portion was easily separated by a small horseshoe magnet into two parts, a magnetic black powder and a nonmagnetic white powder. The magnetic portion examined under the microscope was found to consist of fragments of the globulitic glass, in which were included microlites of the various minerals of the groundmass, particularly labradorite. The nonmagnetic portion consisted of fragments of labradorite free from glass.

Upon dilution of the heavy solution to sp. gr. 2.485, practically all the powder fell. This portion also was nearly all magnetic, and the magnet left only a small residue of white, nearly pure plagioclase powder. The black magnetic portion seen under the microscope resembled that just described. No great difference could be observed between the powder which fell at 2.626 and that which came down at 2.485, except that the nonmagnetic portion was smaller in the latter. This lack of distinctive difference was probably due to the unusual fineness of the powder and its tendency to float in the fluid. It is evident from the experiment, however, that the globulites consist in part of magnetite, and that the latter mineral forms an important, although not conspicuous, constituent of the rock. The specific gravity of the rock as determined by the chemical balance is 2.61. The glass in which the globulites lie must, accordingly, be light.

In an attempt to determine the part played by the considerable percentage of potash shown in the chemical analysis of the rock (Column IV, page 58), a few grains of the magnetic and of the nonmagnetic powder were treated with hydrofluosilicic acid. The magnetic powder afforded abundant crystals of potassium fluosilicate, as well as of sodium and other bases, while the nonmagnetic grains showed only the fluosilicates of sodium, calcium, and aluminium, indicating that the greater part of the potash is in the undifferentiated glass, a result that accords with its low specific gravity.

The other constituents of the groundmass consist of not very abundant grains and crystals of augite, olivine, and magnetite, some small patches of greenish-yellow serpentine, and an occasional small zircon.

A rock remarkably similar to the one just described was found in the Assos collection already referred to. This (A. E. 240) is a dark, compact rock with splintery fracture, resembling a basalt, and labeled as coming from Husseinfagy, Asia Minor. Under the microscope it shows phenocrysts of labradorite and pale-greenish augite. The groundmass shows the same structure as the preceding rock, the same well-developed plagioclase laths, and a glassy matrix thickly crowded with the same dark globulites. The thin section also contains numerous small serpentinous pseudomorphs, after a mineral that was apparently olivine.

In the absence of a chemical analysis it would be hardly safe to assert the practical identity of this rock with the Dardanelle latite; but the work of Washington[1] on the rocks of Smyrna and Pergamon shows that the chemical type of the latites is well represented in this region.

A specimen (1956 S. N.) from the other side of the andesitic ridge, about a mile from the preceding, stands megascopically halfway between the typical Dardanelle facies and the typical Table Mountain facies, showing phenocrysts of labradorite up to 10 mm in length.

Under the microscope the thin section shows the usual labradorite and augite crystals, with smaller ones of magnetite. The olivine is very inconspicuous and appears to be confined to scattered grains or small crystals in the groundmass. The latter, which is rather coarsely hyalopilitic, consists of well-developed laths of plagioclase lying in a light-brown glass. These laths, instead of having squarely truncated ends, show a great tendency toward skeletal forms, splitting up, and projecting long, delicate spines into the glass. Others consist of a thin rectangular shell filled with brown glass. This glass, which occupies a considerable proportion of the slide between the larger laths, has a beautiful frosted appearance, due to its being crowded with still more delicate forms of growth than those of the larger laths. All the latter are well twinned and show extinction angles corresponding to labradorite. Small prisms of apatite and grains of magnetite, augite, and olivine are the other constituents of the groundmass. The glass, when examined with an immersion lens, is seen to be full of minute globulites, which give it its brown color. Some of the larger of these are transparent.

Three-fourths of a mile northward from the locality of the foregoing specimen a remnant of the Dardanelle flow, too small to map without exaggeration, rests upon a larger and broader mass of the biotite-augite-latite. It is very frothy in places, especially near its base, and the specimen (1953 S. N.) taken from the more compact portion shows numerous small round vesicles. Megascopically it resembles closely some of the Table Mountain latite, the labradorite phenocrysts being a little larger and more abundant than in the typical Dardanelle facies. The microscope shows large phenocrysts of plagioclase and smaller ones of olivine and augite lying in a hyalopilitic groundmass.

[1] Am. Jour. Sci., 4th series, Vol. III, 1897, pp. 41-59.

The plagioclases are twinned with beautiful sharpness, frequently combining both albite and Carlsbad laws. Determinations made on such compound twins by the method of Michel Lévy, using the convenient little apparatus devised by Jaggar[1] to tilt the section into the proper positions, indicated a mixture somewhat more basic than Ab_3An_4. These phenocrysts are notable for their frequently very irregular outlines and deep embayments. The bays often exhibit the flow structure of the groundmass more conspicuously than other portions, streams of parallel plagioclase microlites curving in and out of their open mouths, and contrasting with the finer stagnant groundmass caught in the deeper ramifications of the bays, and therefore out of reach of magmatic currents.

Next to labradorite, olivine is the most conspicuous phenocryst—an unusual thing in these latites. It forms well-bounded crystals, in the usual stout prismatic forms, sometimes nearly 0.5^{mm} in length. These phenocrysts are not very abundant, as only five were seen in an ordinary thin section about 1.5^{cm} square. The augite is still less abundant, and in smaller phenocrysts than the olivine.

The groundmass is made up of laths of labradorite, small augites and olivines, grains of magnetite, a few prisms of apatite, and brown glass. The labradorite microlites show a tendency toward skeletal forms resembling those described in the preceding slide.

The last specimen (1886 S.N.) of the Dardanelle flow to be described is from the area one-half mile northeast of McKay's, the most westerly point at which the lava belonging to this flow has been identified. It is here slightly vesicular, with the plagioclase phenocrysts arranged with their longer dimensions distinctly parallel. These are sometimes 10^{mm} in length, and show albite and Carlsbad twinning. Their size and number cause the rock to resemble the typical facies of the Table Mountain flow very closely.

Under the microscope it shows large labradorite phenocrysts with the usual abundant inclusions, lying in a groundmass that is something between hyalopilitic and intersertal. It consists of lath-shaped labradorite microlites, crystals of augite, olivine, and magnetite, and an occasional apatite, lying in a brown glass like that in the section just described. A little serpentine is also present in the groundmass, in part replacing grains of olivine and in part in irregular patches. No phenocrysts of augite or olivine were seen.

Fragments of labradorite, picked out from the powdered rock under the microscope, were found by means of Thoulet solution to have a specific gravity of 2.648, which again is low for a normal plagioclase of the basicity indicated by optical tests. But it is extremely difficult to get fragments that are free from glassy inclusions and at the same time large enough to give the best results when suspended in a heavy fluid.

[1] *A simple instrument for inclining a preparation in the microscope*: Am. Jour. Sci., 4th series, Vol. III, 1897, pp. 129–131.

From the foregoing descriptions it can be seen that the typical facies of the Dardanelle flow resembles that of the Table Mountain flow very closely indeed, while in certain facies they are practically identical. The general distinguishing features of the Dardanelle flow are quantitative rather than qualitative. Its phenocrysts are smaller, the groundmass is finer; olivine is not quite so abundant, and occurs in smaller crystals.

ASSOCIATED VOLCANIC ROCKS.

Olivine basalt, as already mentioned, has been met with only at the West Dardanelle, where it forms a thick series of flows, beneath the latites, and rests in part upon the granite and in part upon rhyolite tuff. It is a dark, even-grained rock, in which the only megascopic phenocrysts are some dark-brown crystals up to 0.5 ^{cm} in length, showing a distinct cleavage, and outlines suggesting pseudomorphs after olivine. A little fresh olivine can also be detected with the lens. This rock weathers much more readily than the latites above it, and is otherwise quite different megascopically.

Under the microscope (1007 S. N.) it shows a typical basaltic or intersertal structure, the well-developed plagioclase laths, averaging nearly 0.5 ^{mm} in length, lying in every direction, with the triangular interstices filled with a nearly opaque glassy base and abundant yellow pseudomorphs after olivine. The plagioclase is perfectly fresh and sharply twinned. Combinations of the albite and Carlsbad laws are frequent, and give extinction angles indicating a labradorite rather more basic than the mixture $Ab_3\ An_4$, probably about Ab_2An_3. Olivine occurs with the usual characteristic outline, and is the only mineral that rises to the rank of a phenocryst. It is very abundant, but is rarely fresh, being usually more or less altered to a bright orange-yellow pseudomorphous mineral, which has received the name of iddingsite.[1] The alteration proceeds from without inward, and all stages may be observed from olivines which have just begun to be attacked to those which have been wholly transformed into yellow pseudomorphs. Occasionally there appears to be an intermediate stage, the olivine being bordered by an ordinary greenish serpentine, and this in turn surrounded by the iddingsite. This relationship, however, suggests the possibility that the iddingsite may be an early, or even a magmatic,[2] alteration, whereas the serpentine is the ordinary product of atmospheric weathering. A similar relation was noted in the diabase of Point Bonita.[3] The iddingsite preserves perfectly the sharp idiomorphic outlines of the olivine. In its cleavage, finely fibrous structure, pleochroism, and double refraction it agrees with the iddingsite described from the much older diabase of Point Bonita, which was regarded as being

[1] Lawson, Geology of Carmelo Bay: Univ. of Calif., Dept. Geol., Bull., Vol. I, 1893–96, pp. 31–36. See also Ransome, ibid., Vol. I, pp. 90–92; and Smith, Proc. Calif. Acad. Sci., 3d series, Geology, Vol. I, 1897, pp. 38–40.

[2] See Washington, Italian petrological studies, II: Jour. Geol., Vol. IV, 1896, pp. 835–836.

[3] Loc. cit.

probably derived from olivine, although the original mineral had all disappeared.

The augite is not abundant, and is rather unevenly distributed in the slide. It occurs in irregular areas between the labradorite laths, with no crystal form of its own, and has the pale-brown tint characteristic of basaltic augites, as opposed to the greenish augites and diopsides of the andesites. Patches of greenish-yellow serpentine are abundant. They are rounded in outline, and appear to fill small vesicles in the glassy base. The latter forms a considerable part of the rock, and is rendered nearly or quite opaque by a fine black dust, probably magnetite. The specific gravity of the rock is 2.78. A chemical analysis will be found in Column VIII of the table on page 58.

Andesitic breccia or tuff of the ordinary Sierra Nevada type is, as already stated, very abundant in this region. It is not, petrographically speaking, a particularly interesting rock, and in spite of its clastic origin the larger fragments show a fairly uniform character over the whole district. They are usually composed of a hornblende-pyroxene-andesite, in which the large brown hornblende phenocrysts are in various stages of resorption in different specimens, so that this mineral is sometimes a conspicuous and abundant porphyritic constituent, occasionally showing crystals up to 2.5^{cm} in length, and at other times has almost wholly disappeared. The other phenocrysts seen in thin section are labradorite, characterized by zonal structure and undulatory extinctions, pale-green augite, orthorhombic pyroxene, and occasionally olivine, all lying in a hyalopilitic groundmass with rather abundant glass. Although many specimens and thin sections have been studied from different parts of the area, three only, collected from the breccia just beneath the latite south of Clover Meadow, will be described in full as fair types of the whole.

The first of these (1437 S. N.) is dark gray in color and shows black phenocrysts of hornblende up to 5^{mm} in length, and a few small plagioclases, lying in a dark, fine-grained matrix. Under the microscope it shows large phenocrysts of brown hornblende with abundant smaller ones of plagioclase, rather less numerous augites, and still less abundant orthorhombic pyroxene. Among the smaller, less conspicuous phenocrysts might also be included olivine and magnetite. The groundmass is light brown in color and hyalopilitic.

The hornblende is the usual brown variety, and the large crystals are rounded in outline and surrounded by the opaque resorption rims common in andesitic rocks. There is frequently also an outer border which is distinguishable from the groundmass in being clearer and in the local abundance of augite and magnetite grains.

The plagioclase phenocrysts give extinctions of albite-Carlsbad twins corresponding to labradorite (Ab_3An_4). They are rather small, but very abundant, and are characterized by zonal structure and undulatory extinctions, particularly in sections approximately parallel to the

brachypinacoid. In this respect they are well contrasted with the sharp regular twinning and definite extinctions of the labradorite of the latites.

The augite is pale green to nearly colorless, and gives extinction angles of $c : \mathfrak{c} =$ about 45°. It is frequently idiomorphic in the prism zone, and is in general like the augite of the latites.

The orthorhombic pyroxene occurs generally in smaller and more slender prisms than the augite. It is in every way similar to that described on page 42 in an andesitic inclusion in the biotite-latite, and, as shown by its faint pleochroism and double refraction, is probably bronzite rather than enstatite.

The olivine is in small grains and irregular crystals and is quite accessory in amount.

The groundmass consists of small microlites of plagioclase, usually showing albite twinning, and brown glass. The rock may be called a hornblende-augite-bronzite-andesite.

A second specimen (1438 S. N.) from the same breccia resembles the preceding, but is a little darker in color and shows numerous crystals of dark olive-green augite 2 or 3 mm in length. The microscope shows large phenocrysts of augite and smaller ones of plagioclase and olivine, lying in a microlitic glassy base. The large augites are very pale yellowish-green in color and nonpleochroic. They sometimes show crystallographic outlines, and are sometimes rounded. The angle $c : \mathfrak{c}$ was found to be at least 46°.

Brown hornblende in large rounded phenocrysts with black resorption rims also occurs in the rock, but only a single fragment was included in the thin section studied.

The plagioclases are prevailingly broad lath-shaped in outline, with a central portion full of small glass inclusions. They generally show twinning according to the albite law, not infrequently combined with the Carlsbad law. The measurements of the extinction angles of these two sets of lamellæ indicate a labradorite rather more basic than Ab_3An_4.

Olivine is rather abundant, in more or less idiomorphic crystals of small size, with occasional larger anhedra, and is quite fresh.

The groundmass is rather glassy, but contains grains of magnetite and abundant small microlites. Lath-shaped microlites of feldspar are, however, notably lacking, and the groundmass can scarcely be called hyalopilitic. Apatite is present in small amount as inclusions in the augite. The rock may be called a hornblende-augite-andesite, but the abundance of the olivine indicates a rather close relationship with the basalts.

A third specimen (1439 S. N.), much like the preceding, but less plainly porphyritic, is dark gray in color and somewhat basaltic in appearance. The lens reveals small plagioclases, with augite and olivine, in a fine dark groundmass. Under the microscope it shows the same general structure as the preceding rocks. The augite, however,

is in smaller phenocrysts and not quite so abundant, and no hornblende appears in the slide. The olivine, on the other hand, is present in rather greater amount, often partly serpentinized. The plagioclase is labradorite (Ab_3An_4), frequently showing wavy extinctions and zonal structure. The inner portions of the crystals are usually the more basic. The rock would be classed as an augite-andesite.

Types of andesite other than those described may be found among the fragments of the breccia in different portions of the region. On the ridge just north of Beaver Creek a beautiful light-gray hornblende-andesite (1966 S. N.) was collected, in which the pyroxene present is confined to an insignificant amount in the groundmass. The hornblende in this facies is green in transmitted light, with the pleochroism $\mathfrak{a}$ = light greenish yellow, $\mathfrak{b}$ = olive green, and $\mathfrak{c}$ = dark yellowish green. The absorption is $\mathfrak{b} = \mathfrak{c} > \mathfrak{a}$, and $c : \mathfrak{c} = 16°$ at least. Another light-gray fragment (1975 S. N.) with conspicuous porphyritic hornblendes, taken from the breccia 3½ miles northeast of Fennessy's, shows the usual brown hornblende in thin section. The groundmass contains abundant small microlites, which appear to be enstatite. A thoroughly typical hornblende-andesite was collected 3 miles south of Big Trees in which the hornblende phenocrysts are abundant. Seen in thin section, they are surrounded by narrow black rims and show strong pleochroism, $\mathfrak{a}$ = light yellowish green, $\mathfrak{b}$ = bright chestnut-brown, and $\mathfrak{c}$ = deep rich mahogany-brown. The absorption is $\mathfrak{a} < \mathfrak{b} < \mathfrak{c}$. The groundmass is typically hyalopilitic and contains a little augite. Other andesites occur in which the hornblende, if, as seems probable, formerly present, has been wholly resorbed, giving pyroxene-andesites in which augite and orthorhombic pyroxenes vary in relative proportions. The rarer accessory minerals of the intermediate effusive rocks are not well represented in the Sierra Nevada andesites. A small crystal of zircon can occasionally be detected, and a single crystal of rutile (?) was noted in one thin section.

No chemical analyses have been made of the andesites of this area, but they probably do not depart from the ordinary Sierra Nevada type, in which total alkalies are generally less than 6 per cent, with soda in excess of potash. Some analyses of these andesites have recently been published by Turner.[1]

Massive rhyolite occurs within the area of the map only at the point previously mentioned, just west of the Dardanelles. It is a fresh, nearly white rock, showing small phenocrysts of sanidine and a pale-pink feldspar, with a few grains of quartz, lying in a cryptocrystalline groundmass. Under the microscope it shows phenocrysts of sanidine with an occasional acid plagioclase and small biotite scales in a nearly colorless, homogeneous, microfelsitic groundmass. The sanidine does not show good crystal outlines, and is without twinning. It has a lower index of refraction than the balsam, a specific gravity as determined

[1] *Seventeenth* Ann. Rept. U. S. Geol. Survey, Part I, 1896, p. 781.

by Thoulet solution of 2.542, and yielded abundant octahedra of potassium fluosilicate with hydrofluosilicic acid. The quartz occurs in little nests of interlocking grains and not as distinct porphyritic crystals. The groundmass shows a few scattered grains of magnetite and a small crystal of zircon.

Rhyolitic tuff is much more abundant than the massive rhyolite within the district studied. It is usually white in color, fine grained, and somewhat friable, although secondary silicification has frequently indurated the exposed surfaces of the beds. The coarser, more crumbling facies generally show fragments of sanidine, microtine, and quartz, and sometimes, as on the south side of the Dardanelles, waterworn pebbles of foreign material. As mentioned in the preceding pages, this tuff sometimes shows columnar structure.

Under the microscope the rhyolite tuff usually shows more or less angular fragments of sanidine, plagioclase, and more rarely quartz, with scales of biotite, lying in a nearly colorless matrix. The latter is almost isotropic, but is generally somewhat chalcedonized. Most of the sections show the "aschen-structur" of Mügge[1] in great perfection, and all intermediate facies occur between those made up of the fresh crescentic glass spicules of a finely comminuted volcanic ash[2] (1823 S. N.) and those in which secondary silicification has in great part replaced the intricate reentrant curves of the glass shards by finely radial, concentric bands of chalcedony, polarizing feebly between crossed nicols, and giving rise to a kind of secondary axiolitic structure common in older rhyolitic tuffs and concerning whose origin there has been some debate (1973 S. N.).

Various tuffs occur within the area embraced by the map which differ somewhat from the ordinary gray andesitic tuffs of the region. They are generally finer, softer, and lighter in color than the latter and are found only in a few small patches. Microscopic investigation shows that they are either andesitic or latitic in character, the distinction between the two being not readily made in their tuffaceous forms.

A mile and a half south of Fennessy's a thin stratum of porous, light-gray tuff (1978 S. N.) rests upon the biotite-augite-latite and separates it from the overlying andesitic breccia. Megascopically this shows abundant small fragments of white pumice inclosed in a finely comminuted volcanic paste. Under the microscope it exhibits numerous areas of nearly colorless pumiceous glass, together with crystals of labradorite, augite, brown and green hornblende, biotite, and apatite. The biotite occurs both as isolated crystals and inclosed in the pumiceous glass. There are also abundant fragments showing microlitic glassy base, some of which appear to be andesite, while others resemble the fine groundmass of some of the massive latites. The apatite is in small prisms, and the slide also contains a little magnetite and *epidote*. The presence of biotite, which was not found in the andes-

[1] *Neues Jahrbuch für Min., etc.*, Beilage-Band 8, p. 648. See also G. O. Smith, Geology of the Fox Islands, Maine, Skowhegan, 1896, p. 39.

[2] *Diller, Science*, Vol. IV, 1884, pp. 651–654.

ites of the region, and the absence of orthorhombic pyroxene, suggest that this tuff may belong to the latitic series.

Just south of Mill Creek, near its mouth, the augite-latite, capping the small hill previously described, is underlain by three beds of soft tuff. The lowest of these is light-yellow, friable tuff, containing fragments of fine white pumice and small rolled pebbles. Under the microscope it is seen to be made up of glass shards showing typical ash structure, with fragments of pumice and a few grains of clastic quartz, the whole being somewhat chalcedonized.

The bed just above this is a fine, white volcanic sand that was not microscopically examined, while the topmost bed is apparently an ordinary andesitic tuff, albeit somewhat finer than is common in this region.

CHEMICAL COMPOSITION OF THE SIERRA NEVADA LATITES.

In the accompanying table (p. 58) the chemical analyses of the latites form all three flows are brought together for comparison. In spite of a certain range in the silica percentages, they are all closely related members of a series. They are not far from the andesites in general composition, but are slightly higher in silica and distinctly so in alkalies, the potash being always slightly in excess of the soda.[1] Compared with typical trachytes, these rocks are higher in lime and magnesia and lower in silica and alkalies, while the preponderance of potash over soda is usually much more marked in the trachytes.

As would be expected from the microscopical study of the thin sections, the rock of the Table Mountain flow is somewhat more basic than the biotite-augite-latite, while the Dardanelle facies occupies an intermediate position. The Shaws Flat rock (Column I) shows the greatest basicity; the greater amount of lime and magnesia, as compared with the other analyses, being in harmony with the slightly greater abundance of olivine and augite as observed in the thin section. Titanic oxide is present in all the analyses, and usually in noticeable amount, indicating that the magnetite of the rocks is probably titaniferous. Analysis VI is exceptional in containing a small amount of carbon, which is doubtless due to some organic matter included in the lava.

The most noteworthy feature of the analyses, however, taken in connection with the mineralogical composition of the rocks, is the amount of potash shown. As already stated, by far the greater number of the thin sections (excepting, of course, the biotitic facies, which, however,

[1] It is important to note that this statement applies only to the percentage figures in the analyses. When the *molecular* proportions of soda and potash are compared it becomes apparent that, as far as the actual mineral-forming efficiency of these alkalies is concerned, it would be more accurate to say that they are very nearly equal; for the soda molecule may sometimes be present in slightly greater amount than the potash molecule, although the preponderance, when reckoned in percentages, is in the other direction. But as rock analyses are not yet, as a general thing, molecularly expressed and compared, the common *mode of* percentage comparison has been retained in the characterization of *the latites. The petrographer* accustomed to translate his chemical analyses into molecular proportions *will not, when reading the following* pages, lose sight of the suggestion embodied in this note.

are no richer in potash than the others) contain no characteristically potash-bearing mineral. Several of the analyses contain as much as 5 per cent of potash, which, if it were present in the form of orthoclase, would make up nearly 30 per cent of the rock. This amount is entirely too large to be accounted for by the assumption that it is present in the form of orthoclase microlites which have escaped detection among the plagioclases of the groundmass. It is fairly certain that nearly all of the potash in those facies which do not contain biotite is present in the residual glass of the groundmass. This conclusion harmonizes with the results of the micro-chemical tests described on page 49, and with the previously noted low specific gravity of the glass.

Frequently[1] in rocks of intermediate composition, like the latites, the orthoclase forms a thin envelope around the basic plagioclases, while in the plutonic monzonites the orthoclase was the last mineral to crystallize, forming a mesostasis for the earlier minerals. In the Sierra Nevada latites the conditions under which orthoclase (or some other potash-alumina silicate) would separate out were never reached. This indicates that the method sometimes employed of assuming the presence of orthoclase in the groundmass of an effusive rock from the character of the bulk analysis is one that requires caution in its use.

Table of chemical analyses of Sierra Nevada latites and associated volcanic rocks.

	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.
SiO_2	56.19 .936	59.88 .998	56.78 .946	59.43 .990	61.09 1.018	62.33 1.039	65.81 1.096	48.76	67.57
TiO_2	.69	.....	1.15	1.38	.....	1.05	.54	1.26	.....
Al_2O_3	16.76 .162	.....	16.86 .163	16.68 .161	.....	17.35 .168	15.11 .146	16.60	.....
Fe_2O_3	3.05 .019	.....	3.56 .022	2.54 .015	.....	2.98 .018	1.85 .011	5.60	.....
FeO	4.18 .058	.....	2.93 .040	3.48 .048	.....	1.63 .022	1.40 .019	5.01	.....
MnO	.10	.....	none	trace	.....	.08	.....	none	.....
MgO	3.79 .094	.....	3.41 .085	1.84 .046	.....	1.05 .026	.37 .009	6.93	.....
CaO	6.53 .116	5.09 .090	6.57 .117	4.09 .073	4.94 .088	3.23 .057	1.98 .035	8.79	.....
BaO	.19	.....	trace	.14	.....	.24	.10	trace	.....
Na_2O	2.53 .040	3.90 .062	3.19 .051	3.72 .059	3.69 .059	4.21 .067	2.59 .041	2.47	5.57
K_2O	4.46 .047	5.06 .053	3.48 .036	5.04 .053	5.27 .055	4.46 .047	5.24 .055	.66	4.33
P_2O_5	.55	.....	.42	.58	.....	.29	.23	.19	.....
H_2O above 110°	.66	.....	1.21	.72	.....	.75	.....	2.19	.....
H_2O below 110°	.34	.....	.15	.27	.....	.44	.....	1.49	.....
	SrO, tr. Li_2O, tr.		CO_2. 18	ZrO$_2$. 08 SrO, tr.		SrO .05 Li_2O, tr. FeS_2. 08			
				Cl .05		C .11		CO_2. 42	
Total	100.02	.....	99.89	100.04	.....	100.33	.....	100.37	.....
Sp. gr	.....	.....	2.67	2.61	.....	2.49	2.38	2.78	2.23

[1] See Washington, Jour. Geol., Vol. IV, 1896, p. 551, for several references.

I. Augite-latite (36 S. N.), Table Mountain flow, Tuolumne Table Mountain, near Shaws Flat. Turner, Rocks of the Sierra Nevada, Fourteenth Ann. Rept. U. S. Geol. Survey, p. 491. Hillebrand, analyst.

II. Augite-latite (86 Tuol.), Table Mountain flow, 3 miles southeasterly from Big Trees. Turner, Geology of the Sierra Nevada, Seventeenth Ann. Rept. U. S. Geol. Survey, p. 727. Fireman, analyst.

III. Augite-latite (1422 S. N.), Table Mountain flow, spheroidal facies, about 1½ miles east of Clover Meadow. Steiger, analyst.

IV. Augite-latite (1419 S. N.), Dardanelle flow, 4 miles southwest of Clover Meadow. Stokes, analyst.

V. Biotite-augite-latite (85 Tuol.), 3 miles southeasterly from Big Trees. Turner, Geology of the Sierra Nevada, Seventeenth Ann. Rept. U. S. Geol. Survey, p. 727. Fireman, analyst.

VI. Biotite-augite-latite (1420 S. N.), 4 miles southwest of Clover Meadow. Turner, loc. cit. Hillebrand, analyst.

VII. Vitrophyric latite (?) (1866 S. N.), just south of Mill Creek. Analysis partial. Steiger, analyst.

VIII. Olivine-basalt (1007 S. N.), west peak of the Dardanelles.

IX. "Red lava" (1867 S. N.), just south of Mill Creek. Ransome, analyst.

CLASSIFICATION OF THE LATITES.

With the great advance in methods of petrographical research during recent years there has come inevitably greater difficulty and complexity in the proper classification of the rocks themselves. The greatly increased accuracy of chemical analyses, particularly as regards amounts of the alkalies and minor constituents, and their more critical interpretation, together with the strides made in the optical investigations of the feldspars by Becke, Federow, Michel Lévy, and others, is leading to the gradual splitting up of some of the older and more comprehensive groups. A notable example of this tendency was Brögger's differentiation of the monzonite family from the syenites, while a similar process has been long reducing the once large family of the trachytes to a size more commensurate with the minor importance of their plutonic equivalents. With the establishment of new families there has come into the literature an enormous number of new names. In many cases these names are local, being based on mineralogical combinations and distinctions that may not be repeated in another region or be given the same value by other observers. The common custom of providing such facies with a name derived from the locality in which they occur is a useful one, but the local, and to a certain extent provisional, nature of such names should be borne in mind, and they should not be allowed to bury under their accumulating mass broader and more rational schemes of classification.

On the other hand, it is no part of pure petrographical science to aim directly at ease and simplicity in classification, however anxiously such an end may be desired by the general geologist. Petrography in its present stage is occupied rightly with critical distinctions. It is only by the recognition of such slight points of difference that they can ever be transcended and assigned their true value in a really rational scheme of rock classification.

Recognizing the fact that igneous rocks are, chemically, mixtures of practically infinite variability within certain limits, the refining tendency *of modern methods* makes more and more for precision of

definition and consequent subdivision of the older groups. This gain in exactness by no means makes easier the classification of a given rock, for it is evident that the greater the number of families the more numerous will be the intermediate or transition rocks, since sharp lines of demarcation apparently nowhere prevail between closely related types. It is a question, of course, how far for purposes of practical description such subdivision of larger groups should go, but it is a question that may very well be answered by the facts of geological occurrence. If a magma of a certain intermediate type with reference to two or more well-established families is found to possess geological unity, and particularly if it is found to be represented by both plutonic and effusive forms, there can be little doubt of the advisability of giving it a distinctive name. Brögger's monzonite magma is an example of such a case, and he has shown very conclusively that the plutonic monzonites, being orthoclase-plagioclase rocks, should be separated from the orthoclase rocks, or granites and syenites, on the one hand and from the plagioclase rocks, or diorites and gabbros, on the other, the mineralogical distinction being the visible sign of difference in chemical composition. In his tabular classification[1] he has indicated the effusive equivalent of monzonite as *trachyt-andesit*, and it is here that the latites of the present paper belong, as will now be more fully shown.

It is plain from the descriptions of the latites in the preceding pages that, in spite of their superficial basaltic character, they are in no sense basalts, being far too high in silica and alkalies and too low in magnesia and lime, and differing from the latter rock in microscopical structure and in the proportion of the ferromagnesian constituents to the feldspars. Their specific gravity, too, is lower than that of basalts of equally compact texture.

Their relation to the andesites is much closer, and were it advisable to crowd them into one of the well-established older groups they would be placed with little hesitation in this family. Leaving out of consideration the glassy base, the particular latites here described possess practically the mineralogical composition of andesites. But they differ from normal andesites in chemical composition, being generally slightly lower in lime and magnesia and always higher in alkalies. In the andesites the total alkalies are as a general rule less than 6 per cent, with soda in excess of potash. In the latites the total alkalies range from 6 to 10 per cent, with the potash equal to or slightly in excess of the soda.

Rocks of this type can hardly be classed as trachytes if the latter name is to retain any precision of meaning. Not only are they decidedly untrachytic in color and texture, but they differ widely mineralogically from typical trachytes. Sanidine, instead of being the dominant feldspar, is entirely absent and the conspicuous feldspar is here

[1] *Die Eruptivgesteine des Kristianiagebietes: II. Die Eruptionsfolge der triadischen Eruptivgesteine bei Predazzo in Südtyrol.* Kristiania, 1895, p. 60.

labradorite. As already noted, Turner[1] has provisionally classed some of the latites with the trachytes on the basis of their chemical composition. The analysis upon which he bases his comparison is quoted from Zirkel's Lehrbuch der Petrographie,[2] and, as Turner remarks, "contains more lime and less silica than most of the analyses given by Zirkel." The analysis in question is one by Ricciardi[3] of the so-called "trachyte" of Bolsena, and is quoted in Column VI of the table of chemical analyses on page 66. Concerning this "trachyte" Washington writes:

> Vom Rath first called attention to the abnormal chemical character of the "trachyte" of Bolsena, though he speaks of it as containing no plagioclase, probably owing to the rarity of the multitude twinning. As will be seen from Klein's descriptions and my own, and from the analyses, the peculiar "trachytes" of the region are remarkable; mineralogically for their richness in plagioclase and the frequent occurrence of olivine as an essential constituent, and chemically for their low silica and high lime and magnesia. Therefore they are not trachytes proper, but correspond to the trachy-dolerites of Abich and Hartung, and to some of the andesitic trachytes of Rosenbusch, and we shall see that they may be regarded as effusive representatives of Brögger's abyssal monzonites. These olivine-free effusive rocks will be called by the name of *Vulsinite*, from the Etruscan tribe Vulsinii, formerly inhabiting this region.[4]

There is thus fresh confirmation of the result already stated, that the latites of the present paper belong neither with the normal trachytes nor yet with the normal andesites, but occupy a position chemically about midway between the two.

Effusive rocks with a chemical composition corresponding to this intermediate taxonomic position appear to be not uncommon, and on page 66 the chemical analyses of a number of such rocks are placed together in tabular form for comparison. Nos. I to XIX inclusive are analyses of latites (which in the table are given the names assigned them by the authors quoted), while No. XX is the mean of the 19 analyses which precede it. Nos. XXI and XXII in the second division of the table are a typical andesite and a typical trachyte respectively, being inserted to show the intermediate character of the latites. The latter as a whole form a fairly uniform chemical series, of which the mean agrees closely with the analysis in Column IX.

But when attention is directed to the names and descriptions of the various effusive rocks embraced in the table they are found to be remarkable more for variety than for uniformity. Thus, besides the latites described in the present paper, there occur such names as *ciminite*, *biotite-vulsinite*, *olivine-bearing andesitic trachyte*, *biotite-dacite*, and *sanidine-bearing andesite*. At first glance such an abundance of names for effusive rocks of a single chemical type seems to indicate little else

[1] Further contributions to the geology of the Sierra Nevada: Seventeenth Ann. Rept. U. S. Geol. Survey, Part I, 1896, p. 729.

[2] Vol. II, 1893, p. 378.

[3] Klein, Petrographische Untersuchung einer Suite von Gesteinen aus der Umgebung des Bolsener Sees: Neues Jahrbuch für Min., etc., B. B. VI, 1889, p. 8.

[4] *Italian petrological sketches*: Jour. Geol., Vol. IV, 1896, p. 547.

than a state of hopeless confusion in rock nomenclature. But while a certain amount of confusion does undoubtedly exist, the multiplicity of names has its chief explanation suggested in two other facts—partly, as pointed out by Iddings,[1] that rock series as they occur in nature may traverse existing schemes of classification at practically any angle, but mainly, in this case, that the name of a rock is generally determined more by its mineralogical than by its chemical composition.

In the case of most igneous rocks, and of nearly all plutonic rocks, the principal mineralogical constituents can be deduced with a fair degree of certainty from an accurate bulk analysis, and, vice versa, from a microscopical examination of a thin section the chemical constitution can be predicted with sufficient accuracy to leave little doubt of the general position of the rock in any ordinary scheme of classification. But with the effusive latites this appears to be true only in a slight degree. In effusive rocks of intermediate chemical composition the circumstances which determine the crystallization of the different possible mineralogical combinations appear to depend upon a very delicate adjustment of physical and chemical conditions. This is already noticeable in the andesites, where a given magma cooling under certain conditions may give rise to a hornblende- or biotite-andesite, and under other conditions, by the magmatic resorption of these two minerals, may solidify as a pyroxene-andesite. The latites, being intermediate rocks par excellence, and containing more or less unindividualized glass in reserve, exhibit this apparent capriciousness of crystallization in an unusual degree.

Thus the vulsinites of Washington "are characterized mineralogically by the presence of alkali feldspar with a large amount of basic plagioclase (labradorite to anorthite), together with augite and diopside. Hornblende and biotite are not abundant in the type specimens, though they may be present in large amounts in other varieties. . . . Olivine is wanting, or if present is so in only accessory amounts."[2] It should be stated that the facies which Washington regards as his most typical vulsinite contains over 9 per cent of potash, and accordingly approaches somewhat nearer to the trachytes than do the typical latites of the Sierra Nevada.

The biotite-vulsinite from Monte Santa Croce (Column II) is particularly interesting with reference to the point under discussion, and the dilemma in which one is placed in attempting to adhere to a purely mineralogical classification of these rocks is well expressed in Washington's own words. He says:

> We have then a rock which is chemically a ciminite and mineralogically a biotite-vulsinite. In regard to the name by which they should be called there may be some doubt. From a mineralogical standpoint they are obviously not ciminite, nor chemically can they strictly be called vulsinite. Since, however, in the schemes of classification in general use at the present time, the mineralogical composition takes

[1] Jour. Geol., Vol. III, 1895, pp. 955–956.
[2] Jour. Geol., Vol. IV, 1896, p. 553.

precedence over the chemical, and bearing in mind the unadvisability of adding new names to the already overburdened nomenclature, I shall designate these rocks as biotite-vulsinite.[1]

The ciminites are "characterized mineralogically by the presence of orthoclase, with basic plagioclase, augite or diopside, or olivine."[2]

The andesite from Carbezo Felipe contains phenocrysts of feldspar and biotite. Sanidine occurs in crystals over a centimeter in length, but the main bulk of the feldspar is labradorite, or a plagioclase between labradorite and andesine. Both monoclinic and orthorhombic pyroxenes are present, and the rock is rich in zircon and apatite. Concerning the classificatory position of this rock Osann writes:

> The proportion of the alkalies shows that the rock stands close to the group of andesitic trachytes—a position which is indicated also by the presence of the large sanidine phenocrysts. The content in lime and potash, contrasted with the small amount of soda, is explained by the fact that basic plagioclase (labradorite) occurs as phenocrysts with the sanidine. If the analysis is compared with the analyses of other andesitic trachytes, in part olivine-bearing (Mte. Amiata, the Arso flow, Mte. Alfina), it is seen to be higher in magnesia. (The Arso rock, in spite of the presence of olivine, has only 1.77 per cent.) This is explained only by the abundance of both biotite and orthorhombic pyroxene.[3]

The augite-andesite from Mount Pagos is "composed of plagioclase, diopside, and biotite, with accessory magnetite, apatite, and zircon, lying in a glass base."[4] The plagioclases are labradorite ($Ab_1 An_1$), but there are possibly a few orthoclase microlites in the groundmass.

The Gleichenberg trachyte contains, according to Hussak,[5] large sanidine phenocrysts, fewer and smaller ones of oligoclase (with extinction angles of 12°–15°), biotite, and dark augite, in a globulitic base.

The augite-andesite from Kara Tash has numerous phenocrysts of labradorite (a little more basic than $Ab_1 An_1$), pale-green diopsides, some biotite, and grains of magnetite, in an abundant, trichitic, glassy base.[6]

The biotite-dacite from Pergamon[7] contains phenocrysts of labradorite, with fewer sanidines, biotite, and olive-green hornblende. The rock is called a dacite on the basis of its chemical composition, although containing no free quartz, thus again illustrating the difficulties attendant upon a consistent mineralogical classification of these intermediate rocks.

The sanidine-bearing andesite of the Rosita Hills is described by Cross[8] as containing plagioclase, orthoclase, quartz, biotite, augite, and

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[1] Jour. Geol., Vol. V, 1897, pp. 250–251.

[2] Ibid., Vol. IV, 1896, p. 838.

[3] Beiträge zur Kenntniss der Eruptivgesteine des Cabo de Gata, II: Zeitschr. Deutsch. geol. Gesell., vol. 43, 1891, p. 720.

[4] Washington, On some igneous rocks from Smyrna and Pergamon: Am. Jour. Sci., 4th series, Vol. III, 1897, p. 44.

[5] Zirkel, Lehrbuch der Petrographie, Vol. II, p. 383.

[6] Washington, loc. cit., p. 44.

[7] Washington, loc. cit., p. 48.

[8] Proc. Colorado Sci. Soc., 1887, p. 248.

accessory minerals. This rock is said to have its chief development in dikes, although occurring also in effusive masses.

The foregoing citations are sufficient to show how great mineralogical variety may be presented by rocks having the peculiar intermediate chemical composition of the latites. It is possible, and perhaps desirable, to assign the more conspicuous and well-marked of these mineralogical combinations separate names, but the number of the latter is apt to be large, and they are of a distinctly lower grade of importance than those rock names which express not only a certain mineral constitution but a corresponding and characteristic chemical composition as well.

It accordingly seems advisable to attempt to bring into common use some more general name to embrace all the effusive rocks standing chemically about midway between the typical trachytes and the typical andesites—a name that can be used as the effusive equivalent of the increasingly important plutonic group of the monzonites. I should gladly have avoided the necessity of introducing a new name into a rapidly growing nomenclature; the more so, as Washington, by his admirable petrographical studies in the Italian volcanic regions, has added so greatly to an accurate knowledge of intermediate rock types which must be necessarily embraced by such a new term. But the Sierra Nevada lavas can not be classed with the typical toscanites, vulsinites, or ciminites, as defined by Washington, although, like the vulsinites and some of the ciminites, they are to be regarded as the effusive equivalents of the monzonites. There is thus a demand for some more comprehensive name to cover the mineralogically diverse forms which the monzonitic magmas, cooling under effusive conditions, may assume. For this reason, and in recognition of the importance and interest of the Italian types described by Washington, the name *latite*, derived from the Italian province of Latium, is proposed as a broader term, comparable in its scope with *monzonite*, to designate the effusive forms of the monzonite magma. Thus it will be seen that certain of the characteristic features of the Sierra Nevada latites, such as the absence of sanidine, the predominance of labradorite, and the presence of a residual alkali-rich glass base, are not regarded as essential in the definition of the general group of the latites as a whole. The latites described in the present paper are merely members of this group, possessing individual characters which would entitle them to names of the same order of importance as the vulsinites, toscanites, etc., of Washington. For the present, however, no such names are proposed.

Abich and Hartung have used *trachy-dolerite* for rocks which in part belong with the latites; Fouqué and Michel Lévy, *trachy-andesites;* Zirkel and Rosenbusch, *andesitic trachyte;* and Brögger *trachyte-andesite.* But all these compounds are open to objection when a name is required for an important group standing midway between the trachytes and the andesites. Such a name should consist of a single word, and

should be free from the undesirable connotations adherent to compounds which have been variously employed.

Referring again to the table of chemical analyses on page 67, it will be seen that in Columns XXIII and XXIV are placed the analyses of two quartz-banakites, chosen as being the nearest known dike equivalents of the latites[1]. The correspondence, however, is not quite perfect, as the two analyses show a slight deficiency in lime and a small excess of alkalies as compared with the mean of the latite analyses. Iddings[2] states that the rocks of these two analyses belong to the banakite series "both mineralogically and chemically, but are somewhat more siliceous, having 5 to 9 per cent more silica. They might properly be given specific names, but at present we prefer to class them with banakite, under the name of quartz-banakite, the amount of quartz, however, being very small."

The banakites are intermediate rocks in the same sense that the latites are. Chemically they possess a rather close analogy with the latter rocks, although somewhat lower in silica, and thus tending through leucitic facies toward the truly alkaline groups of igneous rocks. It is interesting to note that Iddings[3] remarks in this series the tendency toward mineralogical diversity with nearly identical chemical composition, already emphasized in the case of the latites.

In the succeeding columns of the table are placed the analyses of several monzonites, quoted from Brögger, in order to show the close relationship between these plutonic rocks and the effusive latites. Washington has already pointed out this correspondence in the case of his vulsinites and ciminites,[4] and notes as well analogies with the absarokite-banakite series of Iddings.[5]

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[1] After the foregoing was in type my attention was drawn to the dike rock described by Hibsch as occurring in the Bohemian Mittelgebirge, which he has named *gauteite*. (Erlauterung zur geologischen Karte des böhmischen Mittelgebirges: Tschermaks min. u. pet. Mitth., vol. 17, 1897, pp. 84–87.) This rock also is perhaps a dike equivalent of the monzonites and latites, although the chemical analysis shows rather high alkalies.

[2] Absarokite-shoshonite-banakite series: Jour. Geol., Vol. III, 1895, pp. 949–950.

[3] Loc. cit., p. 951.

[4] Jour. Geol., Vol. IV, 1896, p. 832.

[5] Ibid., loc. cit., p. 838. Since the foregoing was written Washington's final paper on the Italian volcanic regions has appeared (loc. cit., Vol. V, 1897, pp. 349–377), in which he divides the rocks between the trachytes and the andesites into two series—the trachyandesites and the trachydolerites, using the former term in a more restricted sense than in his earlier papers, and without the previously employed hyphen. The Sierra Nevada latites would fall most nearly within his trachydolerite series, although not the strict equivalents of any of its individual members. Whether some such single term as that here proposed shall be used to designate the rocks midway between the trachytes and andesites, or whether it will be found practicable to divide them into two series as Washington has done, may, as the latter suggests in a slightly different connection, be left to the winnowing action of time and usage.

Comparative table of chemical analyses.

	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.	XIII.	XIV.	XV.	XVI.	XVII.	XVIII	XIX.	XX.
SiO_2	55.44	55.69	56.19	56.76	56.78	57.97	58.67	59.41	59.43	59.88	60.03	60.88	61.09	61.44	61.93	62.33	63.17	63.49	65.81	59.81
TiO_2	.16	trace	.69	.....	1.15	.....	.....	.01	1.38	.....	.....	.....	.....	.....	.....	1.05	.....	trace	.54	.....
Al_2O_3	18.60	19.08	16.76	16.69	16.86	17.65	15.07	17.92	16.68	.....	17.05	16.19	.....	17.08	18.47	17.35	17.15	18.40	15.11	17.18
Fe_2O_3	2.09	4.07	3.05	2.07	3.56	.63	.....	1.71	2.54	.....	1.83	5.37	.....	3.67	1.93	2.98	2.84	2.44	1.85	5.99
FeO	4.48	3.26	4.18	6.95	2.93	7.50	8.35	2.40	3.48	.....	4.15	1.58	.....	2.42	2.23	1.63	1.31	1.09	1.40	
MnO	.....	trace	.10	.....	.....	.09	.....	.....	trace	.....	.09	.....	.....	.....	.....	.08	.....	.16	.....	.....
MgO	4.75	3.41	3.79	1.63	3.41	1.71	2.97	2.99	1.84	.....	1.12	2.96	.....	1.14	2.66	1.05	2.17	.66	.37	2.27
CaO	6.75	6.87	6.53	6.01	6.57	5.53	8.07	4.65	4.09	5.09	6.58	5.88	4.94	6.21	4.31	3.23	4.17	2.30	1.98	5.25
BaO	.....	.....	.19	.....	.....	.....	.....	.....	.14	.....	.....	.....	.....	.....	.....	.24	.....	.....	.10	.....
Na_2O	1.79	2.89	2.53	2.43	3.19	1.50	3.36	2.63	3.72	3.90	2.31	3.11	3.69	4.06	2.92	4.21	3.08	5.70	2.59	3.13
K_2O	6.63	4.41	4.46	4.67	3.48	5.31	3.50	5.60	5.04	5.06	5.12	3.95	5.27	3.86	3.92	4.46	4.19	4.62	5.24	4.67
P_2O_5	trace	.....	.55	.47	.42	.42	.....	.87	.58	.....	.42	.....	.....	.....	.....	.29	.....	trace	.23	.....
CO_2	.....	.....	.....	.....	.18	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	trace	.....	.....
H_2O above 110°	.25	.17	.66	.....	1.21	.....	.82	1.30	.72	.....	.....	.98	.....	2.04	2.28	.75	2.51	1.04	.....	.....
H_2O below 110°			.34	.....	.15	.....			.27							.44				
Ig	.....	.....	.....	2.44	.....	1.82	.....	.....	.....	.....	1.42	.....	.....	.....	.....	.....	.....	.....	.....	.....
			SrO, t. Li_2O, t.						ZrO_2 .08 SrO, tr. Cl .05							SrO .44 Li_2O, tr. FeS_2 .08 C .11				
Total	100.75	99.85	100.02	100.22	99.89	100.13	100.81	99.49	100.04	.....	100.12	100.70	.....	101.92	100.65	100.33	100.59	99.90	.....	
Specific gravity	2.70	.....	.....	2.47	2.67	2.451	2.705	.....	.....	.....	2.543	2.640	.....	.....	2.601	.....	.....	.....	2.38	

	XXI.	XXII.	XXIII.	XXIV.	XXV.	XXVI.	XXVII.	XXVIII.	XXIX.	XXX.	XXXI.	XXXII.	XXXIII.	XXXIV.
SiO_2	58.47	60.97	57.29	60.89	52.16	52.53	52.81	54.20	54.42	57.66	58.05	58.98	61.72	61.73
TiO_2	.51	.....	.72	.49	.....	.....	.71	.40	.83	.....	.....	.....	.....	.....
Al_2O_3	18.80	20.92	18.45	17.14	22.11	19.48	15.66	15.73	14.28	17.23	17.71	17.34	13.57	17.45
Fe_2O_3	3.34	3.81	4.38	3.32	8.58	11.07	3.06	3.67	3.32	7.28	8.29	3.44	7.60	5.94
FeO	2.64		1.20	.95			4.76	5.40	4.13					
MnO	.13	.....	trace	.09	.....	.....	trace	.70	.10	.....	.....	.....	.33	.....
MgO	2.69	.29	2.08	1.16	2.64	1.53	4.99	3.40	6.12	2.20	2.07	1.64	3.33	2.29
CaO	6.60	.14	3.57	3.58	8.61	6.61	7.57	8.50	7.72	5.32	5.81	8.64	5.88	4.52
BaO	.09	.....	.....	.....	.....	.....	.24	.....	.32	.....	.....	.....	.....	.....
Na_2O	3.58	5.03	4.43	4.54	3.35	2.71	3.60	3.07	3.44	3.41	2.93	3.41	3.12	3.12
K_2O	2.01	8.88	5.43	5.71	2.00	3.17	4.84	4.42	4.22	4.61	3.24	5.34	3.37	3.88
P_2O_5	.22	.....	.46	.27	.....	.....	.75	.50	.59	.....	.....	.....	.....	.....
H_2O	[1].92 [2].14	.83	2.18	1.61	.80	2.34	[1].93 [2].16	.50	[1].38 [2].22	.70	1.34	1.06	.95	1.16
	SrO .05 Li_2O, tr.		NiO .12	NiO .19			SrO .09 Li_2O, tr. Cl .07 Fl, tr. SO_3, tr.		SrO .13 Li_2O, tr.	CO_2 .76				
Total	100.19	100.42	100.31	99.94	100.25	99.44	100.24 .02 100.22	100.50	100.19	99.17	99.49	99.85	99.43	100.09
Specific gravity	.....	2.605	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

[1] Above 110°. [2] Below 110°.

I. Ciminite, Fontana Fiescole, Viterbo, Italy. Jour. Geol., Vol. IV, p. 849. Washington, analyst.

II. Biotite-vulsinite, Monte Santa Croce, Rocca Montino region, Italy. Jour. Geol., Vol. V, p. 252. Washington, analyst.

III. Augite-latite (36 S. N.), Table Mountain, near Shaws Flat, Tuolumne County, Cal. Hillebrand, analyst.

IV. Olivine-bearing andesitic trachyte, Sassara, Italy. Klein, Neues Jahrbuch für Min., etc., B. B. VI, p. 7. Ricciardi, analyst.

V. Augite-latite (1422 S. N.), Table Mountain flow, 1½ miles east of Clover Meadow, Tuolumne County, Cal. Steiger, analyst.

VI. Trachyte (Klein) or vulsinite (Washington), Bolsena, Italy. Klein, Neues Jahrbuch für Min., etc., B. B. VI, p. 8. Ricciardi, analyst.

VII. Ciminite, Monte Cimino, Italy. Jour. Geol., Vol. IV, p. 849. Vom Rath, analyst.

VIII. Andesite, Cabezo Felipe, Cabo de Gata, Spain. Zeitschr. Deutsch. geol. Gesell., vol. 43, 1891, p. 719. Osann, analyst.

IX. Augite-latite (1419 S. N.), 4 miles southwest of Clover Meadow, Tuolumne County, Cal. Stokes, analyst.

X. Augite-latite (86 S. N.), Tuolumne County, Cal., 3 miles southeasterly from Big Trees. Turner, Seventeenth Ann. Rept. U. S. Geol. Survey, p. 729. Fireman, analyst.

XI. Trachyte (Klein) or vulsinite (Washington), San Magno, Italy. Klein, Neues Jahrbuch für Min., etc., B. B. VI, p. 10. Ricciardi, analyst.

XII. Augite-andesite, Mount Pagos, near Smyrna, Asia Minor. Washington, Am. Jour. Sci., 4th series, Vol. III, p. 43. Washington, analyst.

XIII. Biotite-augite-latite (85 S. N.), Tuolumne County, Cal., 3 miles southeasterly from Big Trees. Turner, Seventeenth Ann. Rept. U. S. Geol. Survey, p. 729. Fireman, analyst.

XIV. Trachyte, Gleichenberg, near Steiermark. Tschermaks mineral. Mittheil., 1887, p. 277. Smita, analyst.

XV. Augite-andesite, Kara Tash, near Smyrna, Asia Minor. Washington, Am. Jour. Sci., 4th series, Vol. III, p. 45. Washington, analyst.

XVI. Biotite-augite-latite (1420 S. N.), 4 miles southwest of Clover Meadow, Tuolumne County, Cal. Hillebrand, analyst.

XVII. Biotite-dacite, Pergamon, Asia Minor. Washington, Am. Jour. Sci., 4th series, Vol. III, p. 49. Washington, analyst.

XVIII. Sanidine-bearing andesite, Rosita Hills, Colo. Cross, Proc. Colo. Sci. Soc., 1887, p. 250. Eakins, analyst.

XIX. Vitrophyric latite (?) (1866 S. N.), just south of Mill Creek, Tuolumne County, Cal. Partial analysis. Steiger, analyst.

XX. Mean of the important constituents of the 19 preceding analyses.

XXI. Hornblende-pyroxene-andesite (72 S. N.). Downieville area, Sierra Nevada, Cal. Turner, Seventeenth Ann. Rept. U. S. Geol. Survey, p. 731. Hillebrand, analyst.

XXII. Trachyte (domite), Puy de Dôme, Auvergne. Zirkel, Lehrbuch der Petrographie, II, p. 378. Lewinstein, analyst.

XXIII. Quartz-banakite, dike, near head of Stinkingwater River, Yellowstone Park region. Iddings, Jour. Geol., Vol. III, p. 947. Melville, analyst.

XXIV. Quartz-banakite, dike, locality and reference as above. Melville, analyst.

XXV. Monzonite, Predazzo, South Tyrol. Brögger, Eruptivgesteine des Kristiania-Gebietes, II. Die Eruptionafolge der triadischen Eruptivgesteine bei Predazzo in Südtyrol. Kristiania, 1895, p. 25.

XXVI. Monzonite, Sasinathal, Predazzo. Brögger, loc. cit.

XXVII. Monzonite, Beaver Creek, Bearpaw Mountains, Mont. Weed and Pirsson, Am. Jour. Sci., 4th series, Vol. I, p. 357. Stokes, analyst.

XXVIII. Monzonite, Monzoni, S. Tyrol. Brögger, op. cit., p. 24. Schmelck, analyst.

XXIX. Monzonite, Yogo Peak, Montana. Weed and Pirsson, Am. Jour. Sci., 4th series, Vol. I, p. 357. Hillebrand, analyst.

XXX. Monzonite, Mulatto, Predazzo, S. Tyrol. Brögger, op. cit., p. 25.

XXXI. Monzonite, Malgola, Paedazzo, S. Tyrol. Brögger, loc. cit.

XXXII. Monzonite, Predazzo, S. Tyrol. Brögger, loc. cit.

XXXIII. Monzonite, Blansko, Mähren. Brögger, op. cit., p. 50.

XXXIV. Monzonite, Hodritsch, Hungary. Brögger, loc. cit.

THE EVIDENCE OF THE LAVA FLOWS AS REGARDS OROGENIC MOVEMENTS.

The length of the Table Mountain flow and its favorable position with reference to the present drainage system suggested the comparison of its grade profile with those of the Stanislaus River, including its North and Middle forks, shown in Pl. II. The upper curve in the diagram is that of the base of the Table Mountain flow. Below it are the curves of the main Stanislaus River with its two principal branches, the lower grade being that of the larger Middle Fork. All the profiles are projected upon a vertical plane parallel with the upper and lower edges of the map—a method which, while it exaggerates the actual grade of certain portions of the streams, has the advantage of referring them all to the standard of an ideal consequent stream running straight down the slope and allows the direct comparison of one with another.

The curves as drawn for the existing streams are dependent upon the accuracy with which the canyon contours are laid down on the topographic sheets, while the profile representing the bottom of the lava stream as now dissected is in general somewhat higher than the true bottom of the channel down which it flowed. But the possible error from both sources is probably not large enough to affect seriously the general results to be deduced from a diagram on the scale shown.

The most noticeable fact that appears upon a comparison of the different profiles is the remarkable regularity of the Neocene curve as compared with the curves of the present streams. When there is recalled the great variety of rocks upon which the Table Mountain latite rests, this even character of the curve indicates that the stream which the lava displaced had been highly successful in establishing itself upon a uniform grade. In contrast with this profile, the profiles of the modern streams show some irregularities. The curve of the North Fork is approximately parallel along its middle portion with that of the Middle Fork; but near its junction with the latter stream it becomes considerably steeper, probably on account of the fact that, owing to its greater volume, the Middle Fork has been able to corrade its channel more rapidly than the North Fork, so that the latter stream is at present being lowered near its mouth at a rate too rapid to allow of a corresponding compensation along its entire course. At its upper end, also, the curve of the North Fork departs from its parallelism with that of the Middle Fork, rising rather suddenly and becoming slightly convex. This is due, no doubt, to the weakening of the stream near this point by a splitting up into head-water ramifications which are individually too feeble to cut deep gorges. In the case of the Middle Fork there is no very decided convexity shown, as the stream is much longer and carries its gorge farther back into the range. It is interest-

ing to note that the profile of the Neocene channel also exhibits a slight convexity in the upper regions, as if it, like the North Fork, were approaching its former head-water drainage. But too little is known of the extent and distribution of the latites to the eastward to draw any valuable conclusion from this change in curvature.

The curves, as they stand, give evidence that the Neocene stream bed, down which a portion of the lavas flowed, records the work of a more nearly graded stream than either of its modern representatives, the Middle and North forks of the Stanislaus. It probably flowed, therefore, on a lower grade than the existent rivers, and the present difference of 2,500 feet between the bed of the Middle Stanislaus and the bottom of the Table Mountain flow in the region of the Dardanelles is less than the minimum amount of elevation of this portion of the Sierra slope since the date of the latitic eruptions. Moreover, the great regularity of the Neocene curve indicates that the elevation of this region was effected by a movement or movements which have resulted in at least a superficial resemblance to a simple block tilting, without deformation of the old surface sufficiently great to be appreciable by the methods here used. Lindgren,[1] on the other hand, in his interesting study of the Neocene, Yuba, and American rivers, farther north, found that the elevation was accompanied by deformation, whereby the Neocene channels, instead of showing the regular grade profiles of their modern representatives, appear "to be composed of two curves, with the convex side upward." As the district studied by Lindgren is some hundred miles north of that here described, there is no necessary conflict in the different results arrived at in the two fields.

The channel down which the latite flowed was, as has been shown in the preceding pages, cut during the volcanic period as a whole, and belongs in time with the "intervolcanic channels" of Lindgren, and is therefore younger than the channels of the Neocene Yuba and American rivers, which antedate the main volcanic eruptions. It therefore records only a fraction of the differential uplift during Neocene time. According to Lindgren, the intervolcanic channels of the region described by him exhibit the marks of an erosive activity similar to that of the present day, and are marked by strong grades in whatever direction they flowed.[2]

The Table Mountain channel seems, however, to have been of a slightly different class, and to have been occupied by a long consequent stream of more nearly uniform grade than the present rivers, indicating a considerable interval of erosion between the different andesitic eruptions. The fact that it, on the whole, follows the course of the present Stanislaus, or bisects the angle of its two main branches, indicates that the tilting of the slope has been substantially constant in *direction* since the beginning of Neocene time.

[1] Bull. Geol. Soc. America, Vol. IV, 1893, p. 297.
[2] Loc. cit., p. 295.

SUMMARY.

The contents of the preceding sections may be very briefly summarized as follows:

The area embraced by the map is a fairly typical transverse strip of the middle western slope of the Sierra Nevada, having been worn down to a rough peneplain during the interval between the close of the Juratrias and the beginning of the Miocene. During the Miocene the volcanic eruptions began, which, accompanied by elevation and tilting of the peneplain, lasted to the end of the Pliocene. The first eruptions were rhyolitic, followed by the laying down of a great cloak of andesitic breccias and tuffs. The deposition of the auriferous gravels both preceded and accompanied the deposition of the volcanic material.

The accumulation of the andesitic tuffs and breccias was interrupted by at least one period of considerable erosion, during which a long consequent stream, the predecessor of the present Stanislaus River, established its channel down the slope, cutting through the volcanic cover into the older truncated Bed-rock series along the greater part of its course, and ultimately attaining a very uniform grade. This stream was subsequently displaced by a heavy flow of augite-latite, the Table Mountain flow, which, coming from an as yet unknown source near the crest of the range, ran down the stream bed to the edge of the Great Valley, a distance of more than 60 miles. A second and thinner flow of biotite-augite-latite followed, attaining a greater lateral extent, but not reaching the length of the first flow. The third, or Dardanelle flow, of augite-latite closed the series of latitic eruptions. The volcanic period, as a whole, was brought to an end by fresh andesitic eruptions, as shown by andesitic breccias resting upon the latites, accompanied by a further tilting of the peneplain toward the southwest.

During Pleistocene time the present streams have dissected the Neocene lavas and tuffs, including the latite flows, and have deeply incised the Bed-rock series of Juratrias and older rocks.

The Sierra Nevada latites are mineralogically closely related to ordinary andesites, but chemically they stand between the andesites and the trachytes. They are higher in alkalies than the andesites; the potash is generally slightly in excess of the soda, and, *in the particular rocks described*, is present chiefly in the unindividualized glass when no biotite is present.

Rocks of this intermediate chemical composition are fairly widespread, but are characterized by considerable mineralogical variety. The name latite is proposed as a convenient designation for this entire group of effusive rocks standing chemically between the trachytes and the andesites, and corresponding to the plutonic monzonites of Brögger and possibly to some of the dike banakites of Iddings and the gauteite of Hibsch.

A comparison of the grade profiles of the Neocene stream, down which the latites flowed, with those of the present Stanislaus River, shows that the elevation of the crest of the Sierra Nevada in this region *has been such as* would be produced by a simple block-tilting without *perceptible warping.*

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92. The Compressibility of Liquids, by Carl Barus. 1892. 8°. 96 pp. 29 pl. Price 10 cents.

93. Some Insects of Special Interest from Florissant, Colorado, and Other Points in the Tertiaries of Colorado and Utah, by Samuel Hubbard Scudder. 1892. 8°. 35 pp. 3 pl. Price 5 cents.

94. The Mechanism of Solid Viscosity, by Carl Barus. 1892. 8°. 138 pp. Price 15 cents.

95. Earthquakes in California in 1890 and 1891, by Edward Singleton Holden. 1892. 8°. 31 pp. Price 5 cents.

96. The Volume Thermodynamics of Liquids, by Carl Barus. 1892. 8°. 100 pp. Price 10 cents.

97. The Mesozoic Echinodermata of the United States, by William Bullock Clark. 1893. 8°. 207 pp. 50 pl. Price 20 cents.

98. Flora of the Outlying Carboniferous Basins of Southwestern Missouri, by David White. 1893. 8°. 139 pp. 5 pl. Price 15 cents.

99. Record of North American Geology for 1891, by Nelson Horatio Darton. 1892. 8°. 73 pp. Price 10 cents.

100. Bibliography and Index of the Publications of the U. S. Geological Survey, 1879–1892, by Philip Creveling Warman. 1893. 8°. 495 pp. Price 25 cents.

101. Insect Fauna of the Rhode Island Coal Field, by Samuel Hubbard Scudder. 1893. 8°. 27 pp. 2 pl. Price 5 cents.

102. A Catalogue and Bibliography of North American Mesozoic Invertebrata, by Cornelius Breckinridge Boyle. 1893. 8°. 315 pp. Price 25 cents.

103. High Temperature Work in Igneous Fusion and Ebullition, chiefly in Relation to Pressure, by Carl Barus. 1893. 8°. 57 pp. 9 pl. Price 10 cents.

104. Glaciation of the Yellowstone Valley north of the Park, by Walter Harvey Weed. 1893. 8°. 41 pp. 4 pl. Price 5 cents.

105. The Laramie and the Overlying Livingston Formation in Montana, by Walter Harvey Weed, with Report on Flora, by Frank Hall Knowlton. 1893. 8°. 68 pp. 6 pl. Price 10 cents.

106. The Colorado Formation and its Invertebrate Fauna, by T. W. Stanton. 1893. 8°. 288 pp. 45 pl. Price 20 cents.

107. The Trap Dikes of the Lake Champlain Region, by James Furman Kemp and Vernon Freeman Marsters. 1893. 8°. 62 pp. 4 pl. Price 10 cents.

108. A Geological Reconnoissance in Central Washington, by Israel Cook Russell. 1893. 8°. 108 pp. 12 pl. Price 15 cents.

109. The Eruptive and Sedimentary Rocks on Pigeon Point, Minnesota, and their Contact Phenomena, by William Shirley Bayley. 1893. 8°. 121 pp. 16 pl. Price 15 cents.

110. The Paleozoic Section in the Vicinity of Three Forks, Montana, by Albert Charles Peale. 1893. 8°. 56 pp. 6 pl. Price 10 cents.

111. Geology of the Big Stone Gap Coal Field of Virginia and Kentucky, by Marius R. Campbell 1893. 8°. 106 pp. 6 pl. Price 15 cents.

112. Earthquakes in California in 1892, by Charles D. Perrine. 1893. 8°. 57 pp. Price 10 cents.

113. A Report of Work done in the Division of Chemistry during the Fiscal Years 1891–'92 and 1892–'93. F. W. Clarke, Chief Chemist. 1893. 8°. 115 pp. Price 15 cents.

114. Earthquakes in California in 1893, by Charles D. Perrine. 1894. 8°. 23 pp. Price 5 cents.

115. A Geographic Dictionary of Rhode Island, by Henry Gannett. 1894. 8°. 31 pp. Price 5 cents.

116. A Geographic Dictionary of Massachusetts, by Henry Gannett. 1894. 8°. 126 pp. Price 15 cents.

117. A Geographic Dictionary of Connecticut, by Henry Gannett. 1894. 8°. 67 pp. Price 10 cents.

118. A Geographic Dictionary of New Jersey, by Henry Gannett. 1894. 8°. 131 pp. Price 15 cents.

119. A Geological Reconnoissance in Northwest Wyoming, by George Homans Eldridge. 1894. 8°. 72 pp. 4 pl. Price 10 cents.

120. The Devonian System of Eastern Pennsylvania and New York, by Charles S. Prosser. 1895. 8°. 81 pp. 2 pl. Price 10 cents.

121. A Bibliography of North American Paleontology, by Charles Rollin Keyes. 1894. 8°. 251 pp. Price 20 cents.

122. Results of Primary Triangulation, by Henry Gannett. 1894. 8°. 412 pp. 17 pl. Price 25 cents.

123. A Dictionary of Geographic Positions, by Henry Gannett. 1895. 8°. 183 pp. 1 pl. Price 15 cents.

124. Revision of North American Fossil Cockroaches, by Samuel Hubbard Scudder. 1895. 8°. 176 pp. 12 pl. Price 15 cents.

125. The Constitution of the Silicates, by Frank Wigglesworth Clarke. 1895. 8°. 109 pp. Price 15 cents.

126. A Mineralogical Lexicon of Franklin, Hampshire, and Hampden Counties, Massachusetts, by Benjamin Kendall Emerson. 1895. 8°. 180 pp. 1 pl. Price 15 cents.

127. Catalogue and Index of Contributions to North American Geology, 1732–1891, by Nelson Horatio Darton. 1896. 8°. 1045 pp. Price 60 cents.

128. The Bear River Formation and its Characteristic Fauna, by Charles A. White. 1895. 8°. 108 pp. 11 pl. Price 15 cents.

129. Earthquakes in California in 1894, by Charles D. Perrine. 1895. 8°. 25 pp. Price 5 cents.

130. Bibliography and Index of North American Geology, Paleontology, Petrology, and Mineralogy for 1892 and 1893, by Fred Boughton Weeks. 1896. 8°. 210 pp. Price 20 cents.

131. Report of Progress of the Division of Hydrography for the Calendar Years 1893 and 1894, by Frederick Haynes Newell, Topographer in Charge. 1895. 8°. 126 pp. Price 15 cents.

132. The Disseminated Lead Ores of Southeastern Missouri, by Arthur Winslow. 1896. 8°. 31 pp. Price 5 cents.

133. Contributions to the Cretaceous Paleontology of the Pacific Coast: The Fauna of the Knoxville Beds, by T. W. Stanton. 1895. 8°. 132 pp. 20 pl. Price 15 cents.

134. The Cambrian Rocks of Pennsylvania, by Charles Doolittle Walcott. 1896. 8°. 43 pp. 15 pl. Price 5 cents.

135. Bibliography and Index of North American Geology, Paleontology, Petrology, and Mineralogy for the Year 1894, by F. B. Weeks. 1896. 8°. 141 pp. Price 15 cents.

136. Volcanic Rocks of South Mountain, Pennsylvania, by Florence Bascom. 1896. 8°. 124 pp. 28 pl. Price 15 cents.

137. The Geology of the Fort Riley Military Reservation and Vicinity, Kansas, by Robert Hay. 1896. 8°. 35 pp. 8 pl. Price 5 cents.

138. Artesian-Well Prospects in the Atlantic Coastal Plain Region, by N. H. Darton. 1896. 8°. 228 pp. 19 pl. Price 20 cents.

139. Geology of the Castle Mountain Mining District, Montana, by W. H. Weed and L. V. Pirsson. 1896. 8°. 164 pp. 17 pl. Price 15 cents.

140. Report of Progress of the Division of Hydrography for the Calendar Year 1895, by Frederick Haynes Newell, Hydrographer in Charge. 1896. 8°. 356 pp. Price 25 cents.

141. The Eocene Deposits of the Middle Atlantic Slope in Delaware, Maryland, and Virginia, by William Bullock Clark. 1896. 8°. 167 pp. 40 pl. Price 15 cents.

142. A Brief Contribution to the Geology and Paleontology of Northwestern Louisiana, by T. Wayland Vaughan. 1896. 8°. 65 pp. 4 pl. Price 10 cents.

143. A Bibliography of Clays and the Ceramic Arts, by John C. Branner. 1896. 8°. 114 pp. Price 15 cents.

144. The Moraines of the Missouri Coteau and their Attendant Deposits, by James Edward Todd. 1896. 8°. 71 pp. 21 pl. Price 10 cents.

145. The Potomac Formation in Virginia, by W. M. Fontaine. 1896. 8°. 149 pp. 2 pl. Price 15 cents.

146. Bibliography and Index of North American Geology, Paleontology, Petrology, and Mineralogy for the Year 1895, by F. B. Weeks. 1896. 8°. 130 pp. Price 15 cents.

147. Earthquakes in California in 1895, by Charles D. Perrine, Assistant Astronomer in Charge of Earthquake Observations at the Lick Observatory. 1896. 8°. 23 pp. Price 5 cents.

148. Analyses of Rocks, with a Chapter on Analytical Methods, Laboratory of the United States Geological Survey, 1880 to 1896, by F. W. Clarke and W. F. Hillebrand. 1897. 8°. 306 pp. Price 20 cents.

149. Bibliography and Index of North American Geology, Paleontology, Petrology, and Mineralogy for the Year 1896, by Fred Boughton Weeks. 1897. 8°. 152 pp. Price 15 cents.

150. The Educational Series of Rock Specimens Collected and Distributed by the United States Geological Survey, by Joseph Silas Diller. 1898. 8°. 398 pp. 47 pl. Price 25 cents.

In press:

151. The Lower Cretaceous Gryphæas of the Texas Region, by R. T. Hill and T. Wayland Vaughan. 1898. 8°. pp. 25 pl. Price cents.

152. A Catalogue of the Cretaceous and Tertiary Plants of North America, by F. H. Knowlton. 1898. 8°. pp. Price cents.

153. A Bibliographic Index of North American Carboniferous Invertebrates, by Stuart Weller. 1898. 8°. pp. Price cents.

WATER-SUPPLY AND IRRIGATION PAPERS.

By act of Congress approved June 11, 1896, the following provision was made:

"*Provided*, That hereafter the reports of the Geological Survey in relation to the gauging of streams and to the methods of utilizing the water resources may be printed in octavo form, not to exceed one hundred pages in length and five thousand copies in number; one thousand copies of which shall be for the official use of the Geological Survey, one thousand five hundred copies shall be delivered to the Senate, and two thousand five hundred copies shall be delivered to the House of Representatives, for distribution."

Under this law the following papers have been published:

1. Pumping Water for Irrigation, by Herbert M. Wilson. 1896. 8°. 57 pp. 9 pl.
2. Irrigation near Phœnix, Arizona, by Arthur P. Davis. 1897. 8°. 97 pp. 31 pl.
3. Sewage Irrigation, by George W. Rafter. 1897. 8°. 100 pp. 4 pl.
4. A Reconnoissance in Southeastern Washington, by Israel Cook Russell. 1897. 8°. 96 pp. 7 pl.
5. Irrigation Practice on the Great Plains, by Elias Branson Cowgill. 1897. 8°. 39 pp. 12 pl.
6. Underground Waters of Southwestern Kansas, by Erasmus Haworth. 1897. 8°. 65 pp. 12 pl.
7. Seepage Waters of Northern Utah, by Samuel Fortier. 1897. 8°. 50 pp. 3 pl.
8. Windmills for Irrigation, by E. C. Murphy. 1897. 8°. 49 pp. 8 pl.
9. Irrigation near Greeley, Colorado, by David Boyd. 1897. 8°. 90 pp. 21 pl.
10. Irrigation in Mesilla Valley, New Mexico, by F. C. Barker. 1898. 8°. 51 pp. 11 pl.
11. River Heights for 1896, by Arthur P. Davis. 1897. 8°. 100 pp.

In press:

12. Water Resources of Southeastern Nebraska, by Nelson H. Darton. 1898. 8°. 56 pp. 21 pl.
13. Irrigation Systems in Texas, by William Ferguson Hutson. 1898. 8°. 67 pp. 10 pl.

14. New Tests of Certain Pumps and Water-Lifts used in Irrigation, by Ozni P. Hood. 1898. 8°. pp. 1 pl.
15. Operations at River Stations, 1897, Part I. 1898. 8°. 100 pp.
16. Operations at River Stations, 1897, Part II. 1898. 8°. 101–200 pp.

TOPOGRAPHIC MAP OF THE UNITED STATES.

When, in 1882, the Geological Survey was directed by law to make a geologic map of the United States, there was in existence no suitable topographic map to serve as a base for the geologic map. The preparation of such a topographic map was therefore immediately begun. About one-fifth of the area of the country, excluding Alaska, has now been thus mapped. The map is published in atlas sheets, each sheet representing a small quadrangular district, as explained under the following heading. The separate sheets are sold at 5 cents each when fewer than 100 copies are purchased, but when they are ordered in lots of 100 or more copies, whether of the same sheet or of different sheets, the price is 2 cents each. The mapped areas are widely scattered, nearly every State being represented. More than 800 sheets have been engraved and printed; they are tabulated by States in the Survey's "List of Publications," a pamphlet which may be had on application.

GEOLOGIC ATLAS OF THE UNITED STATES.

The Geologic Atlas of the United States is the final form of publication of the topographic and geologic maps. The atlas is issued in parts, progressively as the surveys are extended, and is designed ultimately to cover the entire country.

Under the plan adopted the entire area of the country is divided into small quadrangular districts (designated *quadrangles*), bounded by certain meridians and parallels. The unit of survey is also the unit of publication, and the maps and descriptions of each quadrangular district are issued as a folio of the Geologic Atlas.

Each folio contains topographic, geologic, economic, and structural maps, together with textual descriptions and explanations, and is designated by the name of a principal town or of a prominent natural feature within the district.

Two forms of issue have been adopted, a "library edition" and a "field edition." In both the sheets are bound between heavy paper covers, but the library copies are permanently bound, while the sheets and covers of the field copies are only temporarily wired together.

Under the law a copy of each folio is sent to certain public libraries and educational institutions. The remainder are sold at 25 cents each, except such as contain an unusual amount of matter, which are priced accordingly. Prepayment is obligatory. The folios ready for distribution are listed below.

No.	Name of sheet.	State.	Limiting meridians.	Limiting parallels.	Area, in square miles.	Price, in cents.
1	Livingston	Montana	110°–111°	45°–46°	3,354	25
2	Ringgold	Georgia, Tennessee	85°–85° 30′	34° 30′–35°	980	25
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6	Chattanooga	Tennessee	85°–85° 30′	35°–35° 30′	975	25
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10	Harpers Ferry	Virginia, West Va., Maryland.	77° 30′–78°	39°–39° 30′	925	25
11	Jackson	California.	120° 30′–121°	38°–38° 30′	938	25
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15	Lassen Peak	California.	121°–122°	40°–41°	3,634	25
16	Knoxville	Tennessee, N.Carolina	83° 30′–84°	35° 30′–36°	925	25
17	Marysville	California.	121° 30′–122°	39°–39° 30′	925	25
18	Smartsville	California.	121°–121° 30′	39°–39° 30′	925	25
19	Stevenson	Alabama, Georgia, Tennessee	85° 30′–86°	34° 30′–35°	980	25
20	Cleveland	Tennessee	84° 30′–85°	35°–35° 30′	975	25
21	Pikeville	Tennessee	85°–85° 30′	35° 30′–36°	969	25
22	McMinnville	Tennessee	85° 30′–86°	35° 30′–36°	969	25
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24	Three Forks	Montana.	111°–112°	45°–46°	3,354	50

*Out of stock.

No.	Name of sheet.	State.	Limiting meridians.	Limiting parallels.	Area, in square miles.	Price, in cents.
25	London	Tennessee	84°–84° 30′	35° 30′–36°	969	25
26	Pocahontas	Virginia, West Va.	81°–81° 30	37°–37° 30′	951	25
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28	Piedmont	Virginia, Maryland, West Va.	79°–79° 30′	39°–39° 30′	925	25
29	Nevada City:					
	Nevada City.	California.	121° 00′ 25″–121° 03′ 45″	39° 13′ 50″–39° 17′ 16″	11.65	50
	Grass Valley.		121° 01′ 35″–121° 05′ 04″	39° 10′ 22″–39° 13′ 50″	12.09	
	Banner Hill.		120° 57′ 05″–121° 00′ 25″	39° 13′ 50″–39° 17′ 16″	11.65	
30	Yellowstone National Park: Gallatin, Canyon, Shoshone, Lake	Wyoming.	110°–111°	44°–45°	3,412	75
31	Pyramid Peak	California.	120°–120° 30′	38° 30′–39°	932	25
32	Franklin	Virginia, West Va.	79°–79° 30′	38° 30′–39°	932	25
33	Briceville	Tennessee	84°–84° 30′	36′–36° 30′	963	25
34	Buckhannon	West Va.	80°–80° 30′	38° 30–39	932	25
35	Gadsden	Alabama	86°–86° 30′	34°–34° 30′	986	25
36	Pueblo	Colorado	104° 30′–105°	38°–38° 30′	938	50
37	Downieville	California.	120° 30′–121°	39° 30′–40°	919	25
39	Truckee	California.	120°–120° 30′	39°–39° 30′	925	25

STATISTICAL PAPERS.

Mineral Resources of the United States, 1882, by Albert Williams, jr. 1883. 8°. xvii, 813 pp. Price 50 cents.

Mineral Resources of the United States, 1883 and 1884, by Albert Williams, jr. 1885. 8°. xiv, 1016 pp. Price 60 cents.

Mineral Resources of the United States, 1885. Division of Mining Statistics and Technology. 1886. 8°. vii, 576 pp. Price 40 cents.

Mineral Resources of the United States, 1886, by David T. Day. 1887. 8°. viii, 813 pp. Price 50 cents.

Mineral Resources of the United States, 1887, by David T. Day. 1888. 8°. vii, 832 pp. Price 50 cents.

Mineral Resources of the United States, 1888, by David T. Day. 1890. 8°. vii, 652 pp. Price 50 cents.

Mineral Resources of the United States, 1889 and 1890, by David T. Day. 1892. 8°. viii, 671 pp. Price 50 cents.

Mineral Resources of the United States, 1891, by David T. Day. 1893. 8°. vii. 630 pp. Price 50 cents.

Mineral Resources of the United States, 1892, by David T. Day. 1893. 8°. vii, 850 pp. Price 50 cents.

Mineral Resources of the United States, 1893, by David T. Day. 1894. 8°. viii, 810 pp. Price 50 cents.

On March 2, 1895, the following provision was included in an act of Congress:

"*Provided*, That hereafter the report of the mineral resources of the United States shall be issued as a part of the report of the Director of the Geological Survey."

In compliance with this legislation the following reports have been published:

Mineral Resources of the United States, 1894, David T. Day, Chief of Division. 1895. 8°. xv, 646 pp., 23 pl.; xix. 735 pp., 6 pl. Being Parts III and IV of the Sixteenth Annual Report.

Mineral Resources of the United States, 1895, David T. Day, Chief of Division. 1896. 8°. xxiii, 542 pp., 8 pl. and maps; iii, 543–1058 pp., 9–13 pl. Being Part III (in 2 vols.) of the Seventeenth Annual Report.

Mineral Resources of the United States, 1896, David T. Day, Chief of Division. 1897. 8°. xii, 642 pp., 1 pl.; 643–1400 pp. Being Part V (in 2 vols.) of the Eighteenth Annual Report.

The report on the mineral resources for the calendar year 1897 will form a part of the Nineteenth Annual Report of the Survey.

The money received from the sale of the Survey publications is deposited in the Treasury, and the Secretary of the Treasury declines to receive bank checks, drafts, or postage stamps; all remittances, therefore, must be by MONEY ORDER, made payable to the Director of the United States Geological Survey, or in CURRENCY—the exact amount. Correspondence relating to the publications of the Survey should be addressed to—

THE DIRECTOR,
UNITED STATES GEOLOGICAL SURVEY,
WASHINGTON, D. C.

WASHINGTON, D. C., *May, 1898.*

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Ransome (F. Leslie).

United States geological survey | Charles D. Walcott, director | — | Some lava flows | of the | western slope of the Sierra Nevada, California | by | F. Leslie Ransome | [Vignette] |
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